RAILROAD GAZETTE

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CONTENTS

Some Features of Recent British and American Express Locomotives.

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It is not the purpose of the present article to discuss the details of British and American locomotives, but to point out some of the general features entering into the design of the express passenger engines of the two countries. To facilitate this the accompanying tables have been prepared, the first one giving data for 12 well-known British express locomotives, while Table II. gives similar information for 17 American designs.

Owing to the restricted loading gage of the British Railways and the different conditions existing, a direct comparison of dimensions is not satisfactory and is unfair to the British locomotive. The tables, therefore, have been arranged to show some of the principal ratios employed in the designs under discussion, especially the boiler power in relation to the cylinder volume and to the weight of the locomotive. The relation existing between grate area and cylinder volume and heating surface and cylinder volume is given, as neither of these factors alone determines the steaming capacity of the boiler, and it is interesting to notice the different ratios provided in boilers designed to burn various kinds of fuel. It is difficult to give figures properly comparing the steaming capacities, as such factors as steam pressure and disposition of the heating surface also enter into the question.

The first three engines in Table I. are of the single-driver type. Many of the fastest and most important British express trains are worked by engines of this pattern. The remarkable success of these engines on roads where grades are easy and trains comparatively light has often led the writer to consider why such locomotives could not do good work in this country. The two Vauclain compound engines of the 4-2-2 type, running on the Philadelphia & Reading Railway, have proved their ability to handle five or six cars on a fast schedule, and they hardly represent the maximum capacity obtainable in this type of locomotive, so far as boiler power is concerned. Such an engine, equipped with a traction increaser—which is omitted in the Reading designs—should be able, on a first-class roadbed, to carry safely 60,000 lbs. on the drivers at starting and a normal load of 50,000 lbs. would be admissible; while, with the 4-2-2 wheel arrangement a fire-box designed for any grade of fuel could easily be provided. The disadvantage of such an engine would be that it could not take its turn with the heavy trains and would have to be kept strictly at the work for which it was designed.

The Great Northern single represents the last of the famous line of express engines designed by the late Mr. Patrick Stirling. The first engine of this class was put on the road in 1870, and the type reproduced, with hardly any variation, for 25 years. The last engines had cylinders 19½ x 28 in., as against 18 x 28 in., employed in the former machines, but the boiler power was not augmented. In fact, the engine appears excessively over-cylindered from every point of view, and no American designer would expect such a locomotive to steam successfully. Yet these engines have demonstrated their ability to handle 200 tons behind the tender at average speeds of over 50 miles an hour, and have an excellent record for fuel economy. They are among the most remarkable engines in Great Britain.

The Midland and Great Central engines are more recent designs, one of the former having been exhibited at the Paris Exposition, where it attracted much attention because of its fine workmanship. These engines have more powerful boilers than the Great Northern locomotive; but they are greatly over-cylindered with reference to their adhesive weight and will never be able to exert their theoretical tractive effort because of the limited weight on the drivers.

The typical British express engine of to-day is of the 4-4-0 type, and the table gives data for four well-known examples. The Great Eastern engine is chiefly interesting as an oil burner, which fuel is used very extensively on this railroad. The Caledonian locomotive may be taken as an excellent representative of a thoroughly modern engine of its class. It is one of the well-known "Dunalastair" line of locomotives and frequently hauls loads of more than 300 tons behind the tender over a road by no means free from gradients at speeds approaching 60 miles an hour. The Caledonian forms part of the well-known West Coast route between London and Edinburgh, and the service that these engines are called upon to perform is very exacting. The boiler is not as powerful as would be supplied to an American engine having the same size cylinders, but the locomotive utilizes its adhesive weight to excellent advantage and is a fine example of modern British practice.

The Great Western 4-4-0 locomotive belongs to the well-known "Atbara" class, and represents a type possessing some interesting features. Like the Caledonian engine, the cylinders are placed inside and the leading axle is cranked, but unlike it the frames and springs are outside the wheels. The boiler is set very high and has no dome, steam being drawn through a perforated pipe. It may be noted here that as all the new Great Western locomotives successfully take their steam in this manner, the absence of a dome does not necessarily result in priming. The fire-box is of the Belpaire type and the smoke-box is extended and is supported on a curved saddle, similar to American practice. A large number of these engines have been built and they are working very satisfactorily. They have a large heating surface for a British locomotive of this type, and weigh slightly less per square foot of heating surface than the Caledonian locomotive.

The London & North Western is the only road in Great Britain that has extensively used compound locomotives in fast express service. The engine is of the four-cylinder balanced type, with high-pressure cylinders outside and low pressure inside, all driving the leading pair of wheels, which necessarily has a cranked axle. The steam distribution is effected by means of one valve motion; there being, however, a separate valve for each cylinder. The ratio of the cylinder volumes is as 1:1.60, which is very low when compared to American and Continental European practice. This class of engine does heavy work in handling the West Coast Scotch express trains, the loads frequently being in excess of 300 tons behind the tender and the schedule speeds over 50 miles an hour. These engines are heavy in proportion to their boiler power, but they are doing efficient service and are being rapidly duplicated. The balanced type of compound is a very promising one, the most advanced examples found to-day being the de Glehn compounds of the 4-4-2 type, running on the Northern of France. As is known by readers of the *Railroad Gazette*, the high and low pressure cylinders of these engines drive separate pairs of wheels, which are coupled by side rods, and two sets of valve gear are employed, making possible an independent cut-off in the high and low-pressure cylinders.

The Great Northern and Lancashire & Yorkshire each have locomotives of the 4-4-2 type in operation, and these engines are tabulated. The Great Northern engine has

TABLE 1.—BRITISH EXPRESS LOCOMOTIVES.

Road.	Date.	Type.	Cylinders, Diam x Stroke. Ins.	Driving Wheels, Diam. Ins.	Steam Pressure. Lbs.	Total Heating Surface. Sq. Ft.	Grate Area. Sq. Ft.	Total Weight. Lbs.	Weight on Driving Wheels. Lbs.	Cylinder Volume. Cu. Ft.	Tractive Effort. Lbs.	Tractive Factor.	Heating Surface. / Grate Area.	Grate Area. / Cylinder Volume.	Heating Surface. / Cylinder Volume.	Wt. on Drivers. / Heating Surface.	Total weight. / Heating Surface.
Great Northern	1895	4-2-2	19½ x 28	96	160	1031.7	20.0	110,900	40,300	9.42	14,680	2.95	51.6	2.12	109	39.1	106
Great Central	1900	4-2-2	19½ x 26	93	200	1194	24.8	105,800	41,100	8.98	18,070	2.27	48.2	2.76	130	34.4	88.6
Midland	1900	4-2-2	19½ x 26	93½	180	1217	24.5	112,300	41,400	8.98	16,170	2.56	49.7	2.73	136	34.0	92.3
Great Eastern	1900	4-4-0	19 x 26	84	180	1630	21.25	113,000	74,400	8.53	17,100	4.35	76.7	2.49	191	45.6	69.3
Caledonian	1900	4-4-0	19 x 26	78	200	1600	23.0	115,800	80,000	8.53	20,455	3.92	69.5	2.69	188	50.0	72.4
Great Western	1900	4-4-0	18 x 26	80	180	1663	21.5	114,600	75,300	7.66	16,110	4.67	77.3	2.80	217	45.3	68.9
London & North Western	1901	4-4-0	16 / 20½ x 24	85	210	1557.5	20.5	129,000	85,100	5.59*	18,000	4.72	76.0	3.67	279	54.7	82.9
Great Northern	1898	4-4-2	19 x 24	78	175	1442	26.75	129,900	69,800	7.88	16,520	4.22	53.9	3.39	183	48.4	90.1
Lancashire & Yorkshire	1899	4-4-2	19 x 26	87	175	2052.8	26.05	131,600	78,400	8.53	16,050	4.88	78.8	3.05	241	38.2	64.1
Highland	1900	4-6-0	19½ x 26	69	180	2050	26.5	131,800	98,200	8.98	21,920	4.48	77.4	2.95	228	47.9	64.3
North Eastern	1901	4-6-0	20 x 26	80¼	200	1769	23.0	150,300	116,400	9.45	22,030	5.29	76.9	2.43	187	65.8	85.0
Great Western	1902	4-6-0	18 x 30	80½	200	2410.3	27.62	151,900	117,600	8.84	20,530	5.71	87.3	3.12	273	48.8	63.0

*High pressure. Tractive efforts here given are calculated on a mean effective pressure equal to 85 % boiler pressure. Tractive Factor = Weight on Driving Wheels. / Tractive Effort.

TABLE 2.—AMERICAN EXPRESS LOCOMOTIVES.

Road.	Date.	Type.	Builder.	Cylinders, Diam x Stroke. Ins.	Driving Wheels, Diam. Ins.	Steam Pressure. Lbs.	Total Heating Surface. Sq. Ft.	Grate Area. Sq. Ft.	Total Weight. Lbs.	Weight on Driving Wheels. Lbs.	Cylinder Volume. Cu. Ft.	Tractive Effort. Lbs.	Tractive Factor.	Heating Surface. / Grate Area.	Grate Area. / Cylinder Volume.	Heating Surface. / Cylinder Volume.	Wt. on Drivers. / Heating Surface.	Total weight. / Heating Surface.
Philadelphia & Reading	1896	4-2-2	Baldwin	13 / 22 x 26‡	84¼	200	1673.5	75.9*	122,000	50,000	4.00†	14,350	3.48	22.0	18.9	418	22.9	72.9
Pennsylvania	1896	4-4-0	P. R. R.	18½ x 26	80	185	1918	33.0	134,500	93,100	8.09	17,500	5.32	58.1	4.08	237	48.5	70.1
Boston & Albany	1899	4-4-0	Schenectady	20 x 26	75	190	2505.3	30.33	136,400	88,500	9.45	22,390	3.95	82.6	3.21	265	35.3	54.5
Delaware, Lackawanna & Western	1900	4-4-0	Schenectady	20 x 26	69	185	2143.3	87.6*	139,000	93,000	9.45	23,700	3.92	24.5	9.27	227	43.4	64.9
Baltimore & Ohio	1900	4-4-2	Baldwin	15 / 25 x 28‡	78	200	2663	42.5	149,600	83,400	5.73†	21,880	3.82	62.7	7.42	465	31.3	56.2
New York Central	1901	4-4-2	Schenectady	21 x 26	79	200	3500	50.0	176,000	95,000	10.4	24,670	3.85	69.7	4.80	336	27.1	50.2
Central R. R. of New Jersey	1901	4-4-2	Brooks	20½ x 26	85	210	2967	82.0*	190,600	99,400	9.93	22,950	4.33	36.2	8.26	299	33.5	64.2
Illinois Central	1902	4-4-2	Baldwin	20 x 28	79	200	3191.7	51.0	178,600	95,700	10.2	24,100	3.97	62.6	5.01	314	30.0	56.0
Pennsylvania	1902	4-4-2	P. R. R	22 x 26	80	205	2640	55.5	177,500	109,500	11.7	27,400	4.00	47.6	4.74	226	41.5	67.2
Chesapeake & Ohio	1902	4-4-2	Schenectady	21 x 26	72	200	3506	50.0	173,000	93,000	10.4	27,070	3.44	70.1	4.80	336	26.5	49.3
New York Central	1899	4-6-0	Schenectady	20 x 28	70	200	2886.2	30.32	164,000	126,000	10.2	27,200	4.63	95.2	2.97	283	43.7	56.8
Big Four	1900	4-6-0	Baldwin	20 x 28	78	200	2858	34.27	174,200	134,000	10.2	24,410	5.49	83.4	3.36	280	46.9	61.0
Chicago & Alton	1901	4-6-0	Baldwin	15½ / 26 x 28‡	68	200	3480.5	34.9	180,800	131,200	6.12†	27,000	4.85	99.7	5.70	569	37.7	52.0
Great Northern	1898	4-6-0	Brooks	20 x 30	63	210	2677	35.4	166,000	129,500	10.9	33,970	3.82	75.6	3.24	246	48.4	62.0
Lake Shore & Michigan Southern	1900	2-6-2	Brooks	20½ x 28	80	200	3343	48.5	174,500	130,000	10.7	25,000	5.21	68.9	4.53	312	38.9	52.2
Atchison, Topeka & Santa Fe	1901	2-6-2	Baldwin	17 / 28 x 28‡	79	200	3738	53.5	209,200	144,600	7.36†	27,420	5.26	69.9	7.27	508	38.7	56.0
Chesapeake & Ohio	1902	4-6-2	Schenectady	22 x 28	72	200	3533	47.0	187,000	131,000	12.3	32,000	4.10	75.2	3.82	287	37.1	52.9

*Fuel, Fine Anthracite. †High pressure. ‡Vauclain Four Cylinder Compound. Tractive effort calculated by means of Baldwin Formula. Tractive efforts for simple engines are calculated on a mean effective pressure equal to 85% Boiler Pressure.

Tractive Factor = Weight on Driving Wheels. / Tractive Effort.

outside cylinders driving the second pair of wheels, as in American practice, while in the Lancashire & Yorkshire engine the cylinders are inside and drive the leading wheels, which have a cranked axle. The latter engine has an unusually large amount of heating surface for a British express locomotive. Considering the boiler power in proportion to the weight, the showing made by the Great Northern engine is not very favorable.

The 4-6-0 type of locomotive has recently been introduced in Great Britain for working heavy traffic, and the three engines tabulated are representative examples. The Great Western locomotive is a very recent production of that company. It is probably the heaviest express engine in Great Britain, and possesses the greatest amount of heating surface found in a British passenger locomotive. The cylinders of all these engines are necessarily placed outside, driving the second pair of wheels. The North Eastern and Great Western engines appear to possess an unusual amount of adhesive weight in proportion to their tractive power and the former engine is very heavy for its boiler power, although it has done good work with the Scotch express traffic of the North Eastern.

During the past few years the British express locomotive has undergone a rapid development and in the effort to produce more powerful locomotives various experimental types have from time to time appeared. Among these may be mentioned the three cylinder compounds on the Midland and the North Eastern. These engines are of the 4-4-0 type, with one inside high pressure cylinder and two low pressure cylinders, with cranks at right angles, placed outside. The high pressure crank is placed at an angle of 135 deg. with each low-pressure crank. These engines thus far have done good work, but they have been regarded only as experimental machines. The London & North Western also has a large number of three-cylinder compounds at work, but Mr. Webb, the locomotive superintendent, has abandoned the three-cylinder arrangement in favor of the four-cylinder balanced type, previously described. Four-cylinder simple engines have also been tried, the latest example being found on the Great Northern. It is of the 4-4-2 type, all pistons being connected to the leading pair of wheels. Mention should also be made of the use of water-tubes in the fire-boxes of recent London & South Western locomotives. These tubes contain about 165 sq. ft. of heating surface, and seem to add materially to the efficiency of the boiler. A combination water-tube and fire-tube boiler for this road was illustrated in the *Railroad Gazette*, April 11, 1902.

Turning now to Table II., we find data given for 17 American locomotives. The characteristic feature of recent American express locomotives is the ample boiler power provided. The Pennsylvania and Chesapeake & Ohio 4-4-2 type locomotives are good illustrations of the fact that, with a modern roadbed, a high tractive effort can be obtained in an engine having but two pairs of drivers. In the Pennsylvania locomotive the normal weight on the drivers is sufficient to enable it to exert its full tractive effort. The Chesapeake & Ohio engine is equipped with a traction increaser which, when in use, raises the tractive factor to about 3.88. A similar device on the well-known New York Central engines increases the tractive factor to 4.33.

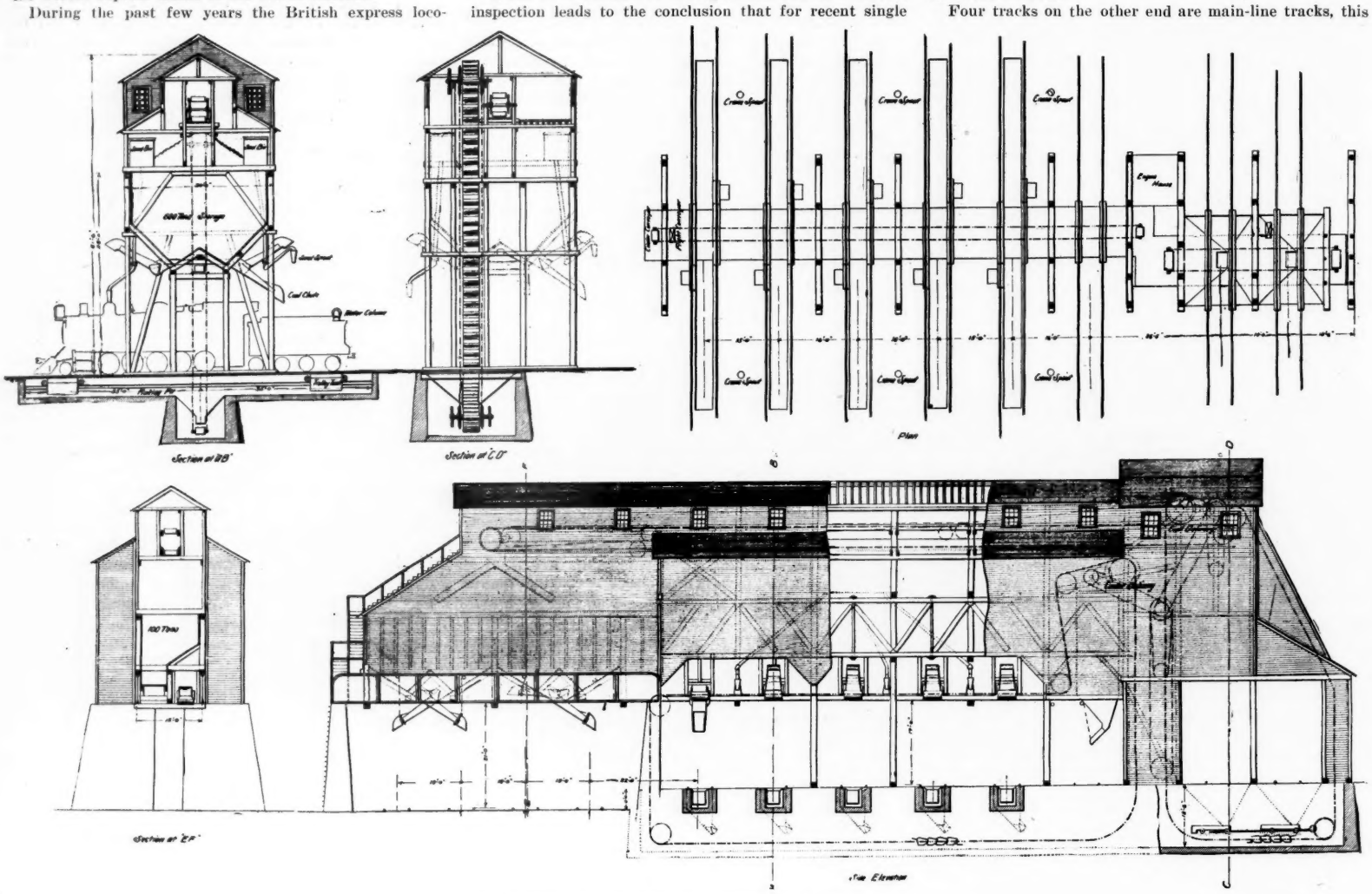
The 4-6-2 type of locomotive for the Chesapeake & Ohio is interesting, having a four-wheeled leading truck and an admirable wheel arrangement. This class of engine is well suited for work on heavy grades and a comparison between it and the Great Northern 4-6-0 engine, designed in 1898 for similar service, shows strikingly what progress has been made. The 2-6-2 type also promises well and the Santa Fe design is interesting because of its enormous heating surface; although indications point to the fact that this figure will soon be exceeded in express passenger locomotives. Attention is also called to the ratios of grate area to cylinder volume in the case of engines designed to burn fine anthracite. Among the single expansion locomotives, the Lackawanna 4-4-0 type leads, with 9.27 sq. ft. of grate area per cubic foot of cylinder volume. The ratios for the compounds are somewhat misleading, as these engines are of course worked at a longer cut-off in the high pressure cylinders than are the single expansion locomotives.

While it is difficult to average these ratios, a careful inspection leads to the conclusion that for recent single expansion bituminous coal burning locomotives the figures are about as follows:

	Htg. Surf. / Grate Area.	Grate Area. / Cylin. Vol.	Htg. Surf. / Cylin. Vol.	Wt. on D'vrs. / Htg. Surf.	Total Wgt. / Htg. Surf.
British engines	75	2.75	200	45	70
American engines	65	4.50	300	35	55

The superiority of the American locomotive so far as boiler power is concerned is thus clearly brought out. It may be said, however, that this superiority does not manifest itself as prominently as might be supposed, for it is well known that British engines are good steamers and very economical with regard to coal consumption. It is probable that in many American designs the engines would steam just as well if the front three or four feet of the tubes could be cut off; in other words, the very long tubes now often employed are due to the wheel arrangement and not specially to a desire to increase the evaporative efficiency, as it would be impossible to bring the tube sheets closer together without radically changing the design. Tubes exceeding 12 ft. in length are comparatively rare on British passenger locomotives.

The tractive factor varies with the conditions, and this figure is frequently high in the compounds, the excess of weight on the drivers becoming useful when live steam is admitted to the low-pressure cylinders. For simple engines having two pairs of drivers a tractive factor of four may be taken as a fair value.



Ft. Wayne Coaling Station—Pennsylvania Company.

A Large Coaling Station for the Pittsburg, Ft. Wayne & Chicago.

What will doubtless be the largest locomotive coaling station ever built is under construction at Ft. Wayne, Ind., for the Northwest System of the Pennsylvania Lines West of Pittsburgh. The station forms a part of the extensive improvements being made at the Ft. Wayne shops and is being installed by the Link-Belt Machinery Co., Chicago. The details and method of operation of Link-Belt system coaling plants are quite familiar to our readers, and a detailed description of the plants installed on the Chicago & Alton may be found in our issue of March 14.

This Fort Wayne station spans 12 tracks. The storage capacity is 700 tons, the pockets for which extend over nine tracks. Five of the tracks have cinder pits, and the arrangement is such that five locomotives at one time, headed either direction, will be able to take coal, sand and water, and dump cinders without changing position. The cinders have a separate carrier which elevates them to a pocket having a capacity for two carloads. They are discharged directly into cars placed on the first track to the right of the pit tracks.

Two tracks at one end of the shed are the coal receiving tracks. These tracks have double track-hoppers into which the coal is dumped and it is conveyed to the overhead storage pockets by a carrier having a capacity of 100 tons an hour.

Four tracks on the other end are main-line tracks, this arrangement being for the purpose of enabling through engines to take coal with the least possible delay. The pocket over these four tracks has a capacity of 100 tons, as against 600 tons for the pocket supplying the pit tracks.

Sand will be blown by compressed air to two overhead bins of 600 cu. ft. capacity each. Six water columns are placed between the pit tracks, three either side of the shed, so that engines standing over the pits may take water which ever way they head.

The plant will be worked by electricity and it is expected to have it done by the early spring.

Railroad Taxes in the State of Michigan.

The State Tax Commission of the State of Michigan has just completed its first assessment of the railroad property in that State under the new law requiring that railroad companies shall pay taxes upon the basis of the value of their property instead of upon their income as formerly. The following is a statement of the equalized value of the companies as reported by the Commission.

Ann Arbor	$7,582,000
Arcadia & Betsey River	75,000
Ausable & Northwestern	275,000
Bear Lake & Eastern	50,000
Chicago, Kalamazoo & Saginaw	550,000
Boyne City & Southeastern	320,000
Chicago, Milwaukee & St. Paul	4,000,000
Chicago & North Western	16,000,000
Cincinnati Northern	350,000
C., C., C. & St. Louis	1,255,000
Crawford & Manistee River	37,000
Copper Range	2,400,000
Detroit & Charlevoix	450,000
Detroit & Mackinac	4,100,000
Detroit Southern	950,000
Detroit, Toledo & Milwaukee	1,800,000
Detroit & Toledo Shore Line	1,500,000
Detroit Union Depot Company	1,700,000
Duluth, South Shore & Atlantic	11,250,000
East Jordan & Southern	140,000
Escanaba & Lake Superior	1,125,000
Fort Street Union Depot Company	1,750,000

Gogebic & Montreal River	550,000
Grand Rapids & Indiana	12,500,000
Grand Trunk	23,895,000
Hecla & Torch Lake	1,025,000
Lake Superior & Ishpeming	1,518,000
Lewiston & Southeastern	48,000
Lake Shore & Michigan Southern	17,000,000
Manistee & Grand Rapids	500,000
Manistee & Luther	175,000
Manistee & Northeastern	1,500,000
Marquette & Southeastern	650,000
Manistique Railway	450,000
Manistique & Northwestern	800,000
Mason & Oceana	150,000
Michigan Suburban	185,000
Michigan Central	47,000,000
Milwaukee, Benton Harbor & Columbus	300,000
Mineral Range	2,500,000
Minneapolis, St. Paul & Sault Ste. Marie	5,500,000
Munising Railroad	700,000
Northern Michigan	35,000
Pere Marquette	27,000,000
Pontiac, Oxford & Northern	1,000,000
Quincy & Torch Lake	300,000
Rapid Railway	7,500
St. Joseph, South Bend & Southern	350,000
Sault Ste. Marie Bridge Company	425,000
South Haven & Eastern	300,000
Toledo & Monroe	375,000
Wabash	3,500,000
Wisconsin & Michigan	225,000
Total	$208,212,500

The average rate of tax assessed against other property for the year is $13.68905 per $1,000, making the total amount of tax assessed against railroad companies $2,850,429 as compared with $1,483,906 paid last year upon their income, or an increase of $1,366,523. It will, therefore, be noticed that the railroad tax under the new plan is nearly doubled.

Piece Work.*

In introducing piece work in a shop it quite often necessitates nearly a complete change in the whole atmosphere, as long continued practices are hard to change, on account of the men having been brought up to the day system. In a general way most men are more or less suspicious or prejudiced against any new or modern system or method of doing work, and anything lacking in the proper management of such a system, will be at once charged against that system, as a part of its weakness.

The day system does not offer sufficient incentive to the workingman. So long as it is only a matter of putting in a certain number of hours daily at a fixed rate, it can be readily understood that men, as a rule, will be hardly likely to exert themselves to become expert in any particular branch.

Again, the day worker, quite often, does not seem to care about the next job he is likely to get, and will stand around until the foreman comes to give him another job, for he says, "this is the foreman's business and is what he is paid for." In other cases the man will ask for another job, but the foreman not having one ready at the moment, will often in the rush give him work to do that will compel the man to make a complete change that might have been avoided had things been thought of beforehand and work been given that was adapted to the previous arrangement.

I have seen some striking examples of the mutual interest which was the outcome of piece work. One was that of a planer hand, who after working piece work for a short time, came to his foreman and pointed out that a certain casting had too much stock to plane off, suggested having the pattern altered so that it would make just as good a job, and a larger number of castings could be put through the planer daily. The pattern was altered, the planing was done in less time, the man's wages increased and the company benefited by less cost in casting, increase in output of machine and greatly reduced cost of production. I doubt very much if under the day system the man would have said anything about such matters.

When a piece work system is about to be introduced the preliminaries must be carefully looked into, so as to avoid changes when it is in force. It should not only have the support of the shop manager but of the superior officers, and time and consideration should be taken and given to study every operation and detail. It may also be necessary to educate the men as to how to improve in the manner of doing their work, for men who have been accustomed, under the day system, of doing the work in their own way and time, do not believe they can improve and do work in less time.

One should strongly bear in mind the great importance of fixing the rates on not what the job has cost in the past, but what it is worth, and not forget that those who have had experience in handling piece work or similar systems, have generally found that the time could be greatly reduced from what it was under the day system.

When the shop changes from the day to piece work system, it should be put into the hands of a competent and experienced man, who should devote his time and energy to improve shop facilities, and instruct and help the foreman and men, getting ready all necessary data concerning the proper rate for each operation, so as to present it for approval to the proper parties. To get this the shop should be put under the slip system, and checked up each day for three or four months, so as to arrive at a fair average. Consideration must be given to men that do vise or erecting work and those running machines, for in the first instance muscular work is called into play, while in the latter the bulk of the work is done by the machines.

If rates are adopted, after due consideration, by a board, and this board held responsible for rates made, I believe there should be little or no necessity for future cutting. If such necessity should arise, full particulars should be given and the rate approved by higher authority. Under the day rate system no foreman would think of raising a man's wages without giving full particulars and having it approved by higher authorities. The same rule should be observed in raising or lowering piece work prices.

The method of time keeping should also be carefully looked into, and kept in such a way that it can be easily checked. It should be made up in harmony with the piece work, and show the total wages of each man, at any time.

*Abstract from a paper presented to the Canadian Railway Club, Nov. 30, 1902, by Mr. Gus Giroux, Mechanical Inspector, Canadian Pacific Railway.

Atlantic Type Locomotive for the Vandalia.

The following is a description of a new VE1 Atlantic type locomotive built for the Vandalia Road by the Schenectady Works of the American Locomotive Company.

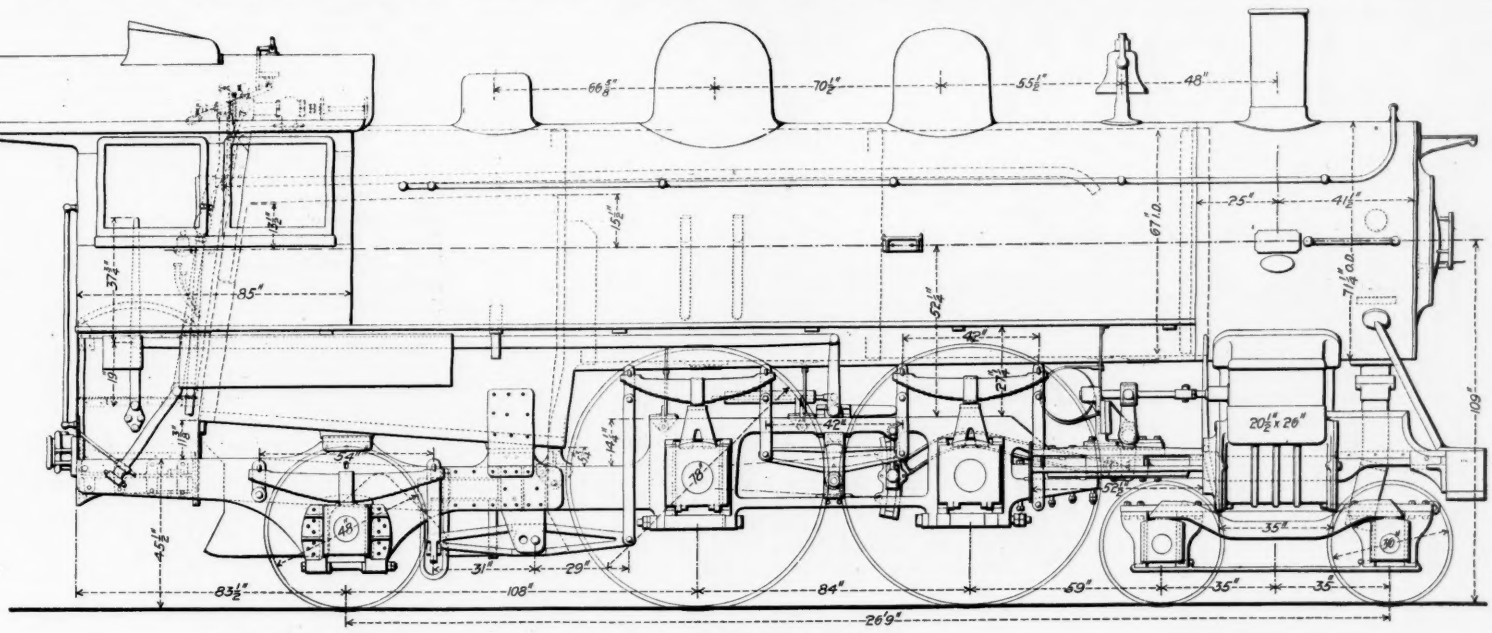
The locomotive has simple cylinders, 20½ x 26 in., and slide valves are used. The valve stem is short and has an outside bearing fastened to the upper crosshead guide. The rocker arm communicates its motion to the valve through a block and slot arrangement. The boiler is straight top and contains 2,987 sq. ft. of heating surface. The injectors are placed on the boiler head, as shown by illustration, and the gage cocks are on the right hand side of the boiler.

The total weight of the engine is 164,500 lbs. and the adhesive weight is 91,500 lbs. The drivers are 78-in. in diameter and the maximum tractive effort is 23,800 lbs. The ratio of total heating surface to weight on drivers is 1 to 30, and indicates that high-speed service is to be required of the machine.

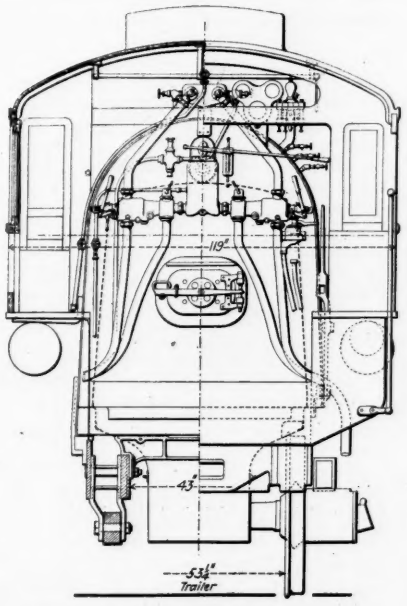
The tender has a capacity of 7,000 gal. of water and 12 tons of coal. The tank is the water-bottom type. Westinghouse-American brakes, with high-speed attachment, are on all drivers and trailers, as well as on tender and train.

A general description follows:

Kind of fuel to be used	Bituminous
Weight on drivers	91,500 lbs.
Weight on truck wheels	73,000 lbs.
Weight total	164,500 lbs.
Weight tender empty	55,000 lbs.
General Dimensions.	
Wheel base, total, of engine	26 ft. 9 in.
Wheel base, driving	7 ft.
Height of stack, above rails	15 ft.
Heating surface, fire-box	170 sq. ft.
Heating surface, tubes	2,817 sq. ft.
Heating surface, total	2,987 sq. ft.
Grate area	46.4 sq. ft.
Wheels and Journals.	
Drivers, number	4
Drivers, diameter	78 in.
Drivers, material of centers	Cast steel
Truck wheels, diameter	36 in.
Journals, driving axle, size	9½ in. x 12 in.
Journals, truck axle, size	6 in. x 10 in.
Cylinders.	
Cylinders, diameter	20½ in.
Piston, stroke	26 in.
Piston rod, diameter	3½ in.
Steam ports, length	18 in.
Steam ports, width	1⅝ in.
Exhaust ports, length	18 in.
Exhaust ports, width	3 in.
Bridge, width	1⅜ in.
Valves.	
Valves, kind of	American balanced
Valves, greatest travel	6 in.
Valves, outside lap	1⅛ in.
Valves, inside lap or clearance	0 in.
Valves, lead in full gear	0 in.
Boiler.	
Boiler, type of	Straight top
Boiler, working steam pressure	200 lbs.
Boiler, thickness of material in barrel	11/16 in.
Boiler, diameter of barrel	68 in.
Seams, kind of horizontal	Sextuple
Seams, kind of circumferential	Double
Thickness of crown sheet	⅝ in.
Crown sheet stayed with	Radial stays
Fire-box.	
Fire-box, length	8 ft. 6 in.
Fire-box, width	5 ft. 5⅝ in.
Fire-box, depth, front	75¾ in.
Fire-box, depth, back	66 in.
Fire-box, water space, width: Front, 4½ in.; sides, 4½ in.; back, 4½ in.	
Grate, kind of	Rocking
Tubes.	
Tubes, number	338
Tubes, outside diameter	2 in.
Tubes, length over sheets	16 ft. 0 in.
Other Parts.	
Exhaust nozzle	Single
Exhaust nozzle, diameters	4¾ in.; 4⅞ in.; 5 in.
Stack, straight or taper	Taper
Stack, least diameter	16 in.
Stack, greatest diameter	17 in.
Tender.	
Tank capacity for water	7,000 gals.
Coal capacity	12 tons
Type of under-frame	10-in. channels
Type of truck	P. R. R. st'd
Diameter of truck wheels	36 in.
Diameter and length of axle journals	5½ in. x 10 in.



Atlantic-Type Locomotive for the Vandalia.



Interior of Cab—Vandalia Locomotive.

Tablet-Exchanging Apparatus—Caledonian Railway.

The Caledonian Railway of Scotland has on its locomotives an apparatus of simple design for delivering train tablets from a moving locomotive at stations, and for taking up tablets from a column or pillar at a station while moving at speed. Both the roadside fixture and the "catcher" on the locomotive are shown in the drawings. The tablet, which is a small, round disk of metal, and which gives the right to the road, the same as the staff in the electric staff system, is placed in a leather pocket; and the tablet *X* on the engine, when it is to be left at a station, is placed in the spring catch *A* of the arm on the engine as shown.

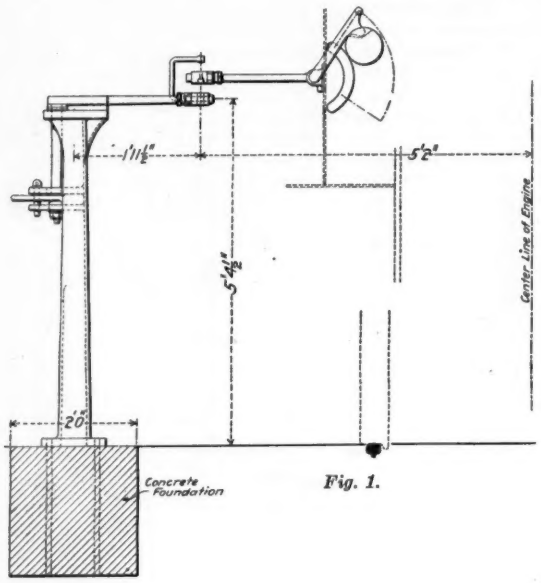


Fig. 1.

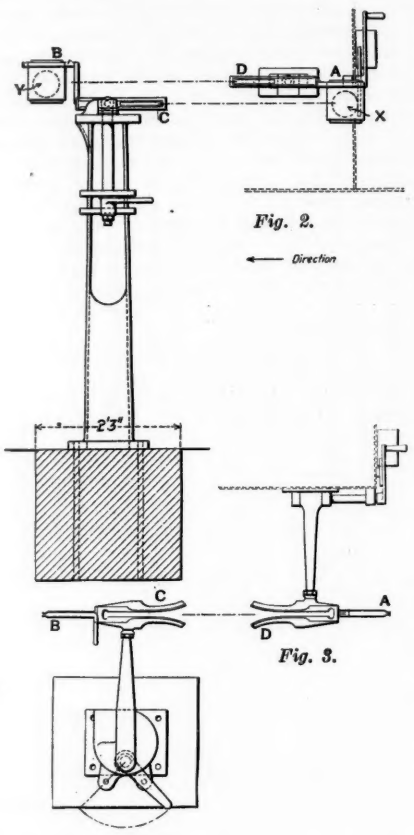


Fig. 2.

Fig. 3.

Tablet-Exchanging Apparatus—Caledonian Railway of Scotland.

The spring catch which holds the leather pocket is shown in plan at *A*, in Fig. 3. The pocket containing the tablet to be picked up is shown at *Y* supported by the catch *B* on the arm at the top of the column or pillar. The arrangement of this arm, which is turned around by revolving a vertical spindle on its axis, is shown in Fig. 3.

Fig. 2 is a side elevation showing the parts as they appear when an engine approaches a station. As the engine passes the column, tablet *X* is caught by the fork *C*; and fork *D*, on the engine, engages with and carries along tablet *Y*. After the exchange has been made the arm on the engine is folded up against the side of the cab, where the tablet can conveniently be taken out and where the arm is out of the way. The arm on the fixed column at the roadside is also turned aside when not in use. For the drawings we are indebted to Mr. J. F. McIntosh, Locomotive Superintendent of the road.

Solidified Crude Oil Fuel.

Last week, in Chicago, a demonstration of some of the characteristics possessed by a new kind of fuel was given before an audience composed largely of members of the Western Society of Engineers. This fuel was formed from Beaumont, Texas, crude oil by a patented process, and was exhibited in briquette form. The inventor, Mr. Austyn Granville, explained the method of production, the conditions under which it may be used advantageously, the cost of the fuel, and other points of interest in connection with it.

This is, of course, not by any means the first time that petroleum has been solidified, with the object of using the resulting product as fuel. But some of the previous substances have been of a character such that their combustion was attended with objectionable features, making their use impracticable; while with others the process of production has been so expensive as to make the cost practically prohibitory. It is claimed for the Granville product that not only is it produced cheaply, but that it contains all of the constituents of the oil, with the exception of a small volume of the inflammable gases which escape during the solidifying process.

The heat value of Beaumont oil has been given as ranging from 17,000 to over 20,000 B. T. U., with 18,500 as an average. The oil from which these briquettes are made has the highest of the heat values given above. During the process of solidifying the sulphur is eliminated and this, together with the escape of the gaseous constitutents as mentioned, reduces this heat value to something like 18,000 B. T. U. The briquettes burn with a strong, hot flame, from the upper surface downward, leaving practically no residuum, that for the all-petroleum form being one-eighth of 1 per cent., it is said. Other constituents such as coal dust, sawdust, refuse from oil refineries and numerous other substances may enter into the composition of the briquettes in any desired proportion, one result of which, however, is a reduction of heat value for the substance. For a great many purposes this is desirable because of the intense heat from the purely petroleum bricks.

Advantages are claimed for the fuel over both coal and liquid petroleum. To burn the latter, boilers must be especially equipped with suitable apparatus; also special facilities for transporting and storing the oil must be provided. There are objections to storing oil in large quantities, chief of which is the danger in case of fire; under many circumstances such storage is not permissible at all. The solidified petroleum will not ignite unless a flame comes in contact with it; also it is claimed that there is no danger from spontaneous combustion.

In comparison with coal, one important consideration is the higher calorific power of the oil fuel. This is of especial importance for vessels, where it would mean increased mileage on a given bunker capacity. The briquettes occupy practically the same space as coal, weight for weight. Another point is its ability to produce steam quickly.

The preferable way for burning the fuel is on a chain grate, the briquettes being fed in uniformly at the front. Air should be admitted *over* the fire, none whatever coming through the grates. It may be burned in locomotives with but few changes, finer grates being necessary to support the fused mass; also provision for admitting the air at the front of the fire-box must be made.

A plant having a capacity of 1,000 tons a day is being built at Port Arthur, Texas, which has a deep-water harbor. Another plant of equal capacity is being built at San Raphael, opposite San Francisco, Cal. These plants may easily be increased to have a capacity of 5,000 tons a day.

The cost of manufacture depends upon the price of oil and of labor in any particular locality. In the Texas field the fuel can be delivered at tide-water at a cost of production of $1.20 per ton. This is doubtless cheaper than it can be produced elsewhere because of the very low price of the oil.

The substance is an active absorbent of water and for that reason the briquettes are provided with an anhydrous coating for protection against moisture. It is possible to compress the substance to several times its normal density, and it is claimed that the time of consumption is increased in the same ratio as the density; this would increase storage capacity.

The Standard Petroleum Briquette Co., capital $2,500,000, has been formed to make the fuel. The headquarters are in the Unity Building, Chicago.

Foreign Railroad Notes.

It is said that work will begin next year on a new Russian line from Erivan, which is 115 miles from Tiflis, to the Persian frontier.

United States Consul G. H. Moulton reports to the State Department that, according to a statement by the new Colonial Governor of Dutch Guiana, the Holland Government intends shortly to build a railroad from Paramaribo to the interior of the colony to develop its natural resources.

The greatest of the French railroad companies has made an important reduction of its train service, chiefly on branch lines. Complaint having been made to the government, the company replies that this was done to reduce expenses and so avoid drawing on the State for the guaranteed interest, which it was compelled to do this year for the first time for a considerable period. The decrease in train service amounts to 4,100 miles daily, and it is expected to save about $1,000,000 a year thereby.

The Steel Plant at Monterey, Mexico.

We find in a recent number of the *American Manufacturer* an article by William White, Jr., describing the steel plant at Monterey. He says that making iron from the ores of northern Mexico was for years a favorite project of the late Don Patricio Milmo upon whose estates large deposits of coal and iron were known to exist, and with whom Eugene Kelly, of New York, was associated. Failing health caused Sir Milmo to retire, so Mr. Kelly carried on the project and associated himself with Messrs. Vicente Ferarra, of Monterey; Antonio Basagoiti and Leon Signoret, of the City of Mexico, and others of Mexico, and New York. In May, 1900, the Compania Fundidora de Fierro y Acero de Monterey was organized with a capital stock of $10,000,000.

The reason for locating the plant at Monterey was that a circle drawn with Monterey as a center, and the distance from Monterey to Laredo as a radius (about 150 miles) contains all the known deposits of iron ore of Bessemer quality, and the greater part of the available coal in the Republic.

The company owns 30,000 acres of the Laredo coal field and is largely interested in that of Barroteran. This latter coal is well suited to make coke for the blast furnaces.

The mines are on the Mexican National and Mexican International Railroads. Ores varying from 40 to 55 per cent. metallic manganese and low in phosphorus are available, so that the manganese required to make steel need not be imported. The plant is on a tract of about 600 acres three miles east of Monterey. The buildings, which are of steel frame and brick and put up by the American Bridge Co., include stock house, cast house, blowing engine house, boiler house, open-hearth building, mill building, rail finishing building, foundry, machine shop, power plant, forge, etc. The annual capacity in tons is as follows: Rails, 40,000; beams and shapes, 40,000; billets and bars, 10,000; pig iron, 30,000; castings, 8,000; total, 128,000 tons.

There are three 35 ton open hearth furnaces, and room is provided for two more, of 50 tons capacity. They are served by a 50-ton electric traveling crane, built by the Morgan Engineering Company, of Alliance, Ohio, and an electric charging machine which charges scrap and cold pig. Molten pig can be charged direct from the blast furnace. It is intended to cast the product of the open hearth furnace into molds standing upright on cars. The reason of making exclusively open hearth steel was that the wide range and variety of the Mexican market demand could be better met by that product; but room was provided on the plans for the addition of a Bessemer plant, adequate to a large output of rails, whenever such a course might become desirable.

Electricity in Railroad Shops.*

The mere economy of transmission is one of the least reasons or advantages to be gained by electric driving, as the mere cost of power is but a small proportion of the total cost of operating the shop. The cost of fuel used, on the average, is not over 3 per cent. of the cost of the article produced (labor and other items, in which time is a factor, representing about 47 per cent., and material the other half). Thus it is patent that the power that goes into the product is a small item in itself, and any saving we may effect in that power is not very important. But if, by introducing a system that effects even a small saving in the cost of power, we can produce a saving of from 5 to 50 per cent. in the cost of product turned out, a saving many times as great as the initial saving which brought it about, the subject becomes interesting and worthy of careful consideration. Notwithstanding the foregoing, the power question is worthy of consideration, and what follows is offered as a brief suggestion covering this phase of the question.

The loss of power from shafting is constant, as long as the engine is running, whether one machine or a hundred be in operation, while the loss of electric transmission is a percentage of the actual power used. For all mechanically driven shops the friction load is a very large percentage of the average load. The friction load depends upon the condition of the shafting, speed, size and number of belts, and the alignment of hangers.

For comparison, take a factory consisting of a single building, three stories high, and 200 ft. long. The engine is near the center and heavy machinery on the first floor; shafting is well disposed, and all the conditions very favorable for good belt driving. The capacity of the engine is 200 h.p. A diagram showing the efficiency in percentage, operating under various loads, is presented herewith. (Fig. 1.)

Curve A represents the efficiency of the mechanical drive, i. e., ratio between the work developed by the engine and the actual effective work. What can rationally be expected under electrical conditions? In such a system there are three sources of loss: First. In transforming mechanical energy into electrical. Second. Losses in conductors and wires. Third. Losses in transforming from electrical energy in the motors. By combining these various values we produce the curve "B" (Fig. 1) which represents the economy of the entire electrical system under various conditions of load. This curve represents the efficiency of an electrical transmission from the pulley of the generator to the pulley of

*Abstract from a paper presented to the Central Railway Club, Nov. 14, 1902, by Mr. L. R. Pomeroy, General Electric Company.

the motor. In order to compare this with the belted factory (Curve A, Fig. 1,) the engine losses must be considered. Taking 90 per cent. as representing the engine efficiency and multiplying the values of curve "B" thereby, we are able to produce curve "C." Comparing this with curve "A," the relative advantage of electricity over belts is shown.

Using the efficiencies laid down on Fig. 1, A and C, we can show by another set of curves the relative coal consumption in a 200 h.p. plant. The upper line (Fig. 2) shows the coal consumption under various loads of the belted plant, the maximum being 122 h.p. of useful work. The next curve shows the coal consumption of the same factory electrically driven. In the latter case, however, 122 effective horse-power is obtained by a gross output of 164 h.p. instead of 200 h.p. Should the factory be run at one-quarter load, the diagram shows that the electrically driven plant will require 48 per cent. less coal than the mechanically driven factory. In plotting these curves, it is assumed that the entire motor plant is in operation continuously. A still greater saving could be effected by shutting down the motors in departments not in actual use.

General observations of electrically driven manufacturing plants have proven the correctness of curve C

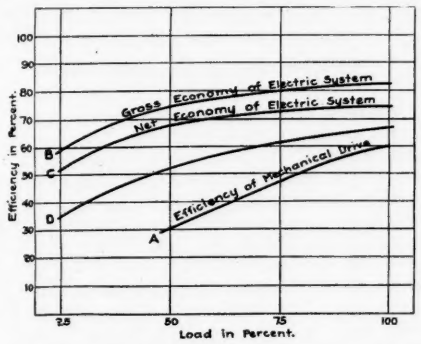


Fig. 1.—Efficiency of Mechanical and Electrical Drives.

(Fig. 1). For example, a plant having a total power rating of 300 h.p. was indicated, and a net efficiency of 70.7 per cent. shown. The curve (C, Fig. 1) shows a full load efficiency of 74 per cent., and as the plant in question had large quantities of shafting retained, we consider that the showing in actual practice is a very close agreement with the curve as drawn.

The electric drive has many advantages over mechanical transmission, but as they are well known, only a few will be mentioned, viz., the ability to shut down departments without interfering with other departments of the factory is important; the ability to arrange machinery irrespective of the lines of the building, thus obtaining sufficient grouping and effective lighting, is another valuable feature. Freedom from shut downs, due to the breaking of belts, the almost instantaneous response to sudden demands for power, and the ease with which additions can be made, are all worthy of consideration.

We have not considered the friction losses in such shafting as it may be necessary to retain, but as we also neglected the increase in friction in the belted scheme as the load increases, we believe that the latter will more than offset the former. The diameter of shafting can be much smaller because the machinery can be grouped and the power applied to the shafts near the center of their length.

However, much care should be taken in the selection of the electrical apparatus. While high-grade electric machinery will show a decided saving in most cases over mechanical transmission, such a saving could not be made should poorly designed electric machinery be installed.

Let us consider a little more in detail the magnitude of the friction loss in shops provided with mechanical forms of transmission. In some exceptional cases, where the works are compact and the machines well placed, the loss may be small; as little as 20 per cent. has been recorded, but this is only obtained where the shafting is short, by using great care in lining of the shaft and adjustment of the bearings and by giving more than ordinary attention to the bearings. It is further only obtained where the shafting and belts are well proportioned to their work and where the load on the machines is constant. In the majority of cases the loss is greater.

The electric motor is unquestionably economical where the average amount of power used is very small compared with the total output of the engine. A comparison may be made with the power used on a cable road. Here the cable corresponds to the line shafting and the friction of the rollers on which the rope moves to the friction in the bearings of the shaft. If many cars are running, the power required to drive the cable is small compared to the total horse-power of the engine, but where there are few cars running on a long cable road, the wasted power may become many times the power required to drive the cars.

It is obvious, other things being equal, that the larger the works and the greater the average distance of the machine from the engine the greater must be the loss in the shafting. It may be expected, therefore, that there are many works where the foregoing losses are exceeded: indeed, it has been stated that in a large cotton mill as little as 1 per cent. of the power of the engine is applied to the cotton itself. Other recorded tests of loss by mechanical transmission are given as follows: Kennedy, 22 per cent.; Richardson, 43 per cent.; Crompton, 32 per cent.; Fessenden (mean of 108 shops), 69 per cent.; Baldwin Locomotive Works (prior to using electric driving), 80 per cent. A test made by the Chicago, Milwaukee & St. Paul, of a planing mill, showed that an average of 500 indicated horse-power was used when machines were under load, and 375 h.p., or 75 per cent., to drive the shafting with all machines idle.

Therefore, the inherent losses common to all systems of transmission are due to the intermittent and irregular use of the machines driven. These are reduced to a minimum with the electric drive. There is no consumption of power when the motor and machine are not in operation. There are no power losses when the motor is not in use; no so-called dead load losses, due to mechanical friction of the shafting system; no transmission losses in the line when the electric current is not required. In addition to the foregoing losses due to direct mechanical transmission, there are further losses due to indirect transmission; namely, when the shops are driven by separate engines, each receiving steam through long pipes running from a central boiler plant.

Loss in steam pipes is frequently the most serious of all, and many times a continuous, loss, night and day. When the pipes are lagged—as laggings in general possess various degrees of efficiency, roughly speaking—the condensation loss amounts to an equivalent in steam of half a ton of coal per annum per sq. ft. of uncovered pipe surface if continually under steam and exposed to the atmosphere, while with the best lagging, the equivalent is one-sixth of a ton.

When the engines are small and scattered about the works they may consume all the way from 50 to 250 lbs. of steam per indicated horse-power per hour. As it is possible to generate electric power in one centrally located power house, with generators driven by steam turbines of moderate size and at greatly reduced first cost over equivalent reciprocating engines, with a guaranteed steam consumption of from 20 to 22 lbs. per k.w. hour, or 12 to 17½ lbs. per i.h.p., the foregoing figures are significant.

Consequently, we are led to believe: First, that electric shop driving permits of a centralized power generation for light and manufacturing purposes; maximum efficiency of workmen, machines and labor involved; intensified production at best speeds and at the power limit of machines with improved quality; maximum output and reduced cost.

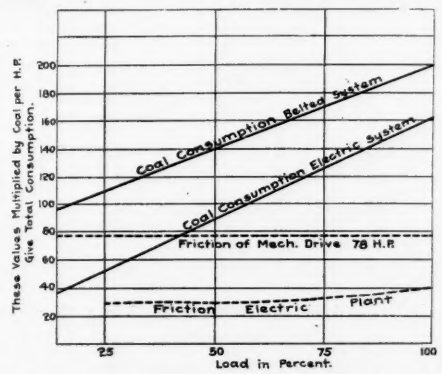


Fig. 2.—Coal Consumption for Mechanical and Electrical Systems.

Second.—The cost of maintenance is a minimum. The depreciation is less than in any other system. The saving effected is much more than sufficient to pay for all the incidental repairs and renewals to the electric machinery or the wiring system. Attendance and supervision can be largely centralized and reduced to a minimum.

Third.—Electric generators and motors are the simplest types of motive power machinery that can be used in the development of the power transmission for manufacturing work.

Fourth.—The arrangement of the tools themselves is not dependent upon the position of the transmission lines, but can be placed independent of all such conditions and arranged solely with reference to the work to be performed.

Fifth.—Permanent additions to the electric generating plant and the distributing system are made with a gradual and pro rata outlay of capital, instead of in disproportionate blocks of new equipment, as required by mechanical transmission.

Sixth.—Advantages of individual drive, are that the workman has the most perfect control of all the factors entering into the economies of production. The productive efficiency of the machine is increased. It may be operated at all times up to the power limit, reducing time and cost of labor for any given product. The choice of the individual drive, however, depends upon the power required, the size of the machine, the time it is in service and the value of the product.

Seventh.—A few large motors are employed independently, driving sections of shafting of most economical length. This method is thus adopted for driving a number of small machines, with no particular requirements in speed or power; or for most economical manufacturing along special lines or independent driving of separate floors, departments or detached buildings.

As an illustration of the saving in operating a large tool by means of individual variable speed drives, the following is presented. (Fig. 3.) Curve No. 1 shows the cutting speed and time to face a 72 in. cast-iron disk from a maximum diameter of 72 in. to a minimum diameter of 6 in., using three different steps on the cone pulley, the time for shifting the belt from one cone to the next not included.

Curve 2 shows a test on a similar lathe driven by a motor with field control. The cone pulleys on a mechanically driven tool do not permit the tool to start at the maximum cutting speed, and in this case, the operator having no guide but his eye, did not change the speed on the cone pulley as soon as desirable for greatest production. With the electrically driven tool, the cut begins and ends at the maximum cutting speed that the work permits. The workman gradually increases the speed with the controller as the diameter of the work reduces, thereby maintaining a constant cutting speed. The diagram shows that the belt-driven lathe required 59 minutes to complete the cut, while the motor-driven lathe did the same work in 31 minutes, or 53 per cent. of the time.

As to the necessity of variable speed in a railroad shop, or rather how much or how far it is desirable to go in this regard, is a mooted question. My experience has been that not over 30 per cent. of the tools in such a shop require it, and very seldom is it necessary to change the speed after the work is set in the machine. Consequently, very little electric speed variation will meet most requirements. Ordinarily, when the workman has properly fixed the work in the machine, he can readily change the belt to the proper cone or gear, that gives the desired speed.

Again, with a motor with slight variation in field-winding, increasing the cost of the motor only about 5 per cent. over standard types or constant speed motors, an increase in speed of 25 per cent. above normal may be obtained by field weakening; or 40 per cent. below normal by interposing armature resistance is possible.

Next in point of cost is the use of a special type of motor, giving 100 per cent. field regulation. By this type of motor the varying requirements of almost any tool can be met at a slightly increased cost over constant speed or standard motors. This, in the writer's judgment, is a rational method of meeting the case, as the range of speed is liberal, and its cost moderate. By varying the current flowing in the field coils of a motor, the strength of the magnetic field is changed and the speed of the motor varied. With any setting of the field, the motor will give constant speed under changes of load, and this method therefore avoids the greatest objection to rheostatic control.

A motor of ordinary design will not permit of any considerable field weakening without deleterious sparking at the commutator, but with a special motor having small armature reaction, a variation in speed of 2 to 1 can readily be obtained, and when delivering a constant horse-power the current will be approximately the same at all speeds because the potential across the armature terminals is always the same. As the field current of a motor is only a small fraction of the total current, the efficiency of this method of control is practically the same at minimum and maximum speeds and allows the use of a much smaller controller and renders it possible to get a greater number of running speeds than can be economically arranged for with any other control.

With the three-wire multiple voltage system, and a motor arranged for 100 per cent. field control, a variation of 4 to 1 can be given, but the cost will be in the neighborhood of 150 per cent. greater than the standard constant speed motor, while with the four-wire multiple voltage scheme, a speed of about 7 to 1 is possible but the cost will be about 250 per cent. greater than the standard motor. In the latter case a 9 h.p. motor is required to furnish a maximum power of 2 h.p., through a range of speed from 164 to 1,200 r.p.m.

There is a rapidly growing sentiment in favor of the use of alternating current apparatus, as this type has

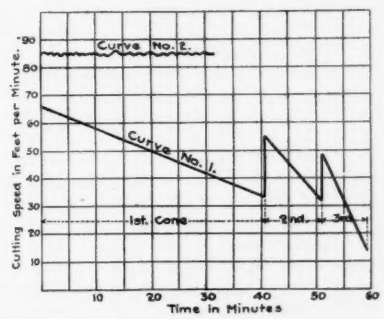


Fig. 3.—Relative Speed of Electric and Belt Driven Lathes.

many valid claims over direct-current machines, and the rapid introduction of practical mechanical variable speed mechanism or the use of magnetic clutch speed changes, makes the induction motor as flexible and available for variable speed as the direct current motor. Ordinarily, the special layout of the shop plant, the distance the power has to be transmitted, lighting of stations, freight houses and remote buildings, generally determines whether d.c. or a.c. shall be used. There is no apparatus for effectively transforming direct current from high to low pressure, while the alternating current is readily and simply transformed. It is this characteristic that has given the alternating current its great commercial success. The description of the induction motor is negative; no commutator, no collector rings, no brushes, nothing to handle but the switch, nothing to wear but self-

oiled bearings, no exposed parts, no danger from fire; the machine composed of a rotor and a stator.

The Baldwin Locomotive Works claim that the introduction of electricity made a direct saving of 20 per cent. in the pay rolls and 40 per cent. in shop area. The introduction of cranes, made possible by the introduction of electricity, enables the reduction of the laboring force by one-tenth of that previously employed. The advantages of cranes are a legitimate claim in favor of electricity, for the reason that expeditious and efficient cranes are impossible without electricity.

Presupposing a typical railroad shop comprising several buildings, there are three ways in which electric power may be applied, each varied in the amount of first cost, and the corresponding advantages thereof are directly proportional:

First.—The simplest and most elementary method would be the erection of a central power station, conducting the current to each building and operating by a single motor of sufficient capacity to run the shop.

Second.—The same as in the foregoing, but apply group driving in each shop by a motor for each department or to economical sections of main line shafting. This latter form, like the first, would not demand any re-arrangement in location of tools.

Third.—Same as in case one, but re-arrange the tools with reference to departments and locations, providing for a given sequence of work through the shop. Remove overhead shafting and thereby make possible the use of electric cranes where advantageous. Such shafting as necessary to be retained can be carried on brackets to side walls or main columns. Arrange for such a combination of group and individual drives, as will place constant speed tools as far as possible in the groups, and provide individual drives for such tools as demand variable speed or are more or less isolated or used intermittently.

A shop manager commencing by adopting plan number one would soon see the advantages of plan number two, and the experience with plans one and two would readily lead to a recommendation of plan number three. In addition to the general advantages of electric shop driving, the central power station can provide for shop, station and yard lighting, operating turn-tables, water and coal stations, without addition to the power station force.

The Electric Train Staff on Raton Mountain.

As the readers of the *Railroad Gazette* already know, the electric train staff, made by the Union Switch & Signal Company, has been in use for about a year on a section, 23 miles long, of the Atchison, Topeka & Santa Fe in Colorado and New Mexico, where the grades are very steep, and where, in consequence of the large number of engine movements, the handling of trains by time-table and telegraphic orders was peculiarly difficult. General Manager H. U. Mudge has sent us the following statement, showing the volume of business done over this portion of the road for a period of 10 days, which, in connection with the profile of the line shown in the engraving, will give the reader a good idea of the problems which have to be met in moving traffic over this busy line.

The left of the profile is east and the right is west. The staff stations are Trinidad, Jansen, Starkville, Morley, Cima, Wootton, Lynn, Hillside and Raton. Between Cima and Morley the line is double-track; but all of the other sections are worked by the staff. A crane is used to deliver staffs to enginemen while running at speed, and for this purpose the staff is put into a rubber pouch about 10 inches long. Semaphore signals are provided at the entrances to the passing tracks at each station, so that enginemen may be informed, as soon as they come in sight of a station, what to expect from the staff operator. The permissive staff, allowing one train to follow another within the same block section, is used only by instructions from the train despatcher. When this is used the five-minute time interval is maintained. As the use of the permissive staff is prohibited for down-grade movements on certain sections, care has to be taken, when necessary, to send this staff, with its tickets (by a train running under the absolute block movement) to the end of the section where the permissive arrangement is to be employed. At some of the stations a dwarf signal, placed at the foot of the regular home semaphore, is used as a calling-on signal, to notify trains to move forward to the station.

Mr. Mudge's statement follows:

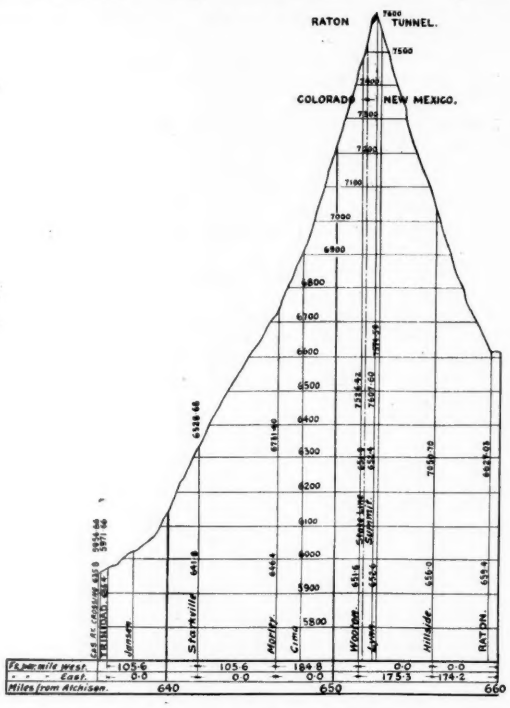
During the period of 10 days from Oct. 10 to Oct. 19 inclusive, the following trains were handled: Eastbound.—Forty-one passenger trains, total 410 cars, average 10 cars per train; 91 freight trains, total 2,247 loads, 793 empties, average 24.7 loads, 8.7 empties per train; 160 light engines; total 292 trains. Westbound.—Forty-seven passenger trains, total 415 cars, average 9.7 cars per train; 100 freight trains, total 2,736 loads, 447 empties, average 27.4 loads, 4.5 empties per train; 165 light engines; total 312 trains. Average per day, eastbound, 29.2 trains; average per day, westbound, 31.2 trains; total average per day, both directions, 60.4 trains.

Where light engines are run two or three coupled together, down the mountain, they are counted as one engine.

From the best figures obtainable, freight trains are saved a delay of one hour in passing over the 23 miles covered by the staff system. We are unable to note that any saving in time is made by passenger trains; in fact, there seems to be a small delay of perhaps an average of 10 minutes for each train on account of the positive block used with the staff system in descending grades, as against a 10 minute time interval which was used previous to adopting the staff system.

No train orders are delivered to engine or trainmen. The orders are sent to operators in the same form and manner that they are sent to conductors and enginemen on other parts of the line, with the exception that the operators copy them in a book instead of upon manifold. They are repeated in accordance with standard rules. If it is desired to have two trains meet at a certain station, the operator would be instructed in the order, to side track, for instance, train No. 1 until train No. 2 arrived. Signals are provided at both ends of the passing tracks and the operator instructs the approaching trains whether (1) to come ahead on the main line, expecting to receive staff signal, (2) to come down main line and stop at staff office, or (3) to take the siding at the point where the signal is located.

Each intermediate station is provided with two staff machines, one for eastbound and one for westbound movement. The machines are provided with one permissive staff and six permissive tablets. Trains descending grade are governed by absolute, while trains ascending grade may be run by permissive staff. When the permissive staff is used, each train is given a permissive tablet, except the last, which is given the remaining permissive tablets and staff. All the tablets and the staff must be placed in the machine before other trains can be moved.



Profile of Atchison, Topeka & Santa Fe; Raton Mountain.

The figures showing feet per mile indicate the maximum (not the average) in their respective sections.

Staff stations are connected by telephone as well as by telegraph, the telephone being used exclusively by the operators in handling the staff, and the telegraph wires by the despatchers in sending orders to operators.

Cranes have been provided at staff stations whereby the engineer is enabled to pick up the staff while running 30 miles an hour, without difficulty, so that trains are not delayed in exchanging staff at stations where they are not required to stop. The saving in time in handling freight trains by this system is the result of having to deliver the staff to the leading engineman only, whereas, formerly, it was required to deliver a copy of all orders affecting the train to each engineman, and as there are generally four engines on each freight train, two on the head end and two in the rear, a large saving in time is effected from that source alone.

There was considerable doubt in the minds of despatchers and train and enginemen when the system was first inaugurated as to its practicability, but since working with it the men would very much dislike to return to the old system of handling trains by train orders.

More Plants for U. S. Steel.

The Union and Sharon Steel Companies, which were about to be consolidated and considerably enlarged, have been absorbed by the United States Steel Corporation. Judge Gary, on behalf of the United States Steel Corporation, on Dec. 16 gave out a statement embodying details of the transaction:

"The Finance and Executive Committees of the United States Steel Corporation," he said, "accompanied by the Presidents and other prominent officers of the subsidiary companies of the Steel Corporation, have recently made an inspection of the Union and Sharon steel plants, now controlled by the Union Steel Company, and as a result the Finance Committee, by direct negotiation, has purchased the same for the Steel Corporation.

"These plants are located near Pittsburgh, on the Monongahela River, and at Sharon, respectively. They were started some time before the formation of the United States Steel Corporation, and not in opposition to it. These properties have wire, nail and other works in operation as going properties. When fully completed they will have five more blast furnaces and 25 open-hearth furnaces, capacity to manufacture 7,500 kegs of nails daily, new and modern tube mills, bar mills, tin mills, sheet mills, plate mills, etc.

"They have about 5,000 acres of coking coal in the Connellsville region, besides nominal railroads in the coke region, 6,200 acres of fuel coal on the Monongahela River, limestone properties, and valuable developed ore mines in the Mesaba region and Marquette region, containing about 40,000,000 tons of ore, two lake steamers, and steel railroad cars.

"The Steel Corporation pay the exact cost of the manufacturing plants, to be determined by auditors appointed for that purpose. For the real estate, ore properties, and the coal lands they will pay something more than the cost value, but not to exceed the present market value. The stockholders of the Union and Sharon plants agree to furnish about $10,000,000 new cash, to be expended in the completion of improvements and further development of the properties in such manner as the Steel Corporation may determine.

"The manner of paying for the property will be by a bond issue of $45,000,000, secured on the property and the principal and interest guaranteed by the Steel Corporation. For the actual money put into the manufacturing property the stockholders will receive these bonds at par. For the value of real estate, ore and coal they will receive bonds at par, and for the $10,000,000 of new cash they will receive bonds at par. The remainder of the bonds will be kept in the treasury for use at some future time in such further development of the property as may be decided on by the Steel Corporation.

"The sellers' profit in the transaction arises solely from their profit in operating their plants to date, and in the increased value of their ore, coal and real estate, which were purchased some time ago.

"There is an advantage over purchase for the steel corporation, as the properties are located near their other plants, and the general expense of managing the business with the addition of these two large and modern plants will not be increased, and also for the reason that the corporation is now short of pig iron and open-hearth capacity."

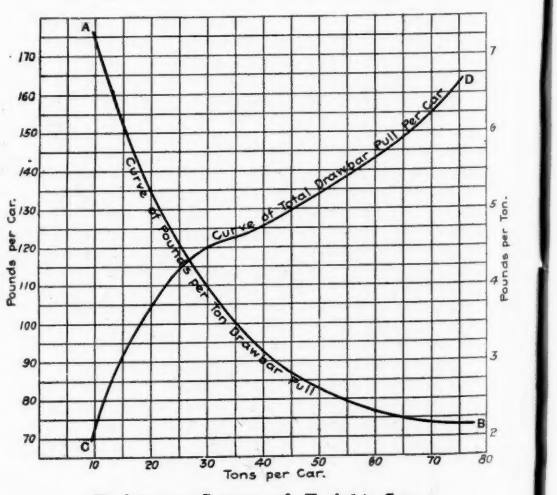
Draw-Bar Pull Rating of Engines.*

It has been frequently alleged, and is undoubtedly true, that an empty car has a higher draw-bar pull per ton than a loaded car, but when an empty and a loaded car are of the same gross weight their draw-bar pull is practically the same. For instance, a 100,000 lb. capacity steel car, weighing empty 40,000 lbs., had a draw-bar pull of 5.85 lbs. per ton, while a wooden hopper car weighing empty 26,000 lbs., and loaded to a gross weight of 40,000 lbs. gave a draw-bar pull of 5.82 lbs. per ton. The pull of the hopper car empty, however, was 6.75 lbs. per ton. It is therefore evident that in rating engines by draw-bar pull, the matter of loaded or empty cars may be disregarded, the gross weight only being necessary.

In order to show the variation in draw-bar pull for various weights of cars, two curves are shown made up from figures obtained by dynamometer car tests covering a period of over six months, and including some 10,000 cars.

The curve showing the pounds per ton draw-bar pull is very regular, and shows how much less the pounds per ton is for heavy cars than for light ones; but when we multiply the pounds per ton by its proper weight of car as shown by C. D., the character of the curve is entirely changed, and we see at once the importance of taking care of the resistance of each car separately, instead of the "adjusted" method of adding a fixed average factor to each car regardless of weight. The curves given are for a straight and level track. In order to find the draw-bar pull for any weight of car for any given grade and curve, it is simply necessary to add the draw-bar pull due to grade alone to the draw-bar pull for level tangent, and, if any curve, also add the product of the degree of curve times 1.35. This result, multiplied by the weight of car in tons, gives the total draw-bar pull for that car on the given grade. When this is done for each weight of car, all the results may be placed in the form of a table.

The draw-bar pull of the engine in pounds becomes the rating for that grade; it may be found by dynamometer car or by calculation, but my experience has been that a few train loading tests over the grade will fix the engine rating very satisfactorily.



Resistance Curves of Freight Cars.

I have found, during the course of some road tests, that a simple and quite accurate way of obtaining the draw-bar pull of various weights of cars over any grade or curve is as follows, it only being necessary to know the figures for a level tangent: Let us suppose that an engine, exerting a draw-bar pull of 20,000 lbs., hauls a

*Abstract of a paper, by Mr. H. A. Fergusson, Assistant Superintendent of Motive Power, Chicago Great Western, presented to the North West Railway Club, October, 1902.

train of 30 cars, weighing 1,500 tons, over a certain grade and curve at the required speed. If we divide 20,000 by 30, the number of cars, we find that the average draw-bar pull per car is 667 lbs. Also by dividing 1,500 tons by 30 we find that 50 tons is the average weight per car. Then by dividing 667 by 50 we get 13.34 lbs., as the average draw-bar pull per ton for a 50 ton car.

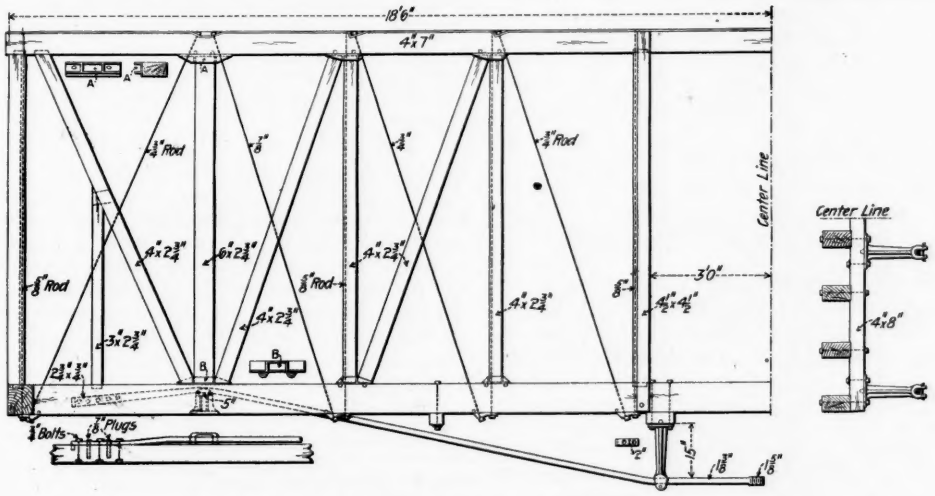
The draw-bar pull for a 50 ton car on a level tangent is 2.6 lbs. Therefore 13.34 minus 2.6, or 10.74, is the pounds per ton draw-bar pull for that grade or curve, and is constant for any weight of car. For other weights than 50, add to 10.74, their level tangent resistance in pounds per ton, multiply by the weight of car, and we have the figure for our loading table.

Since the variation in resistance for various weights of cars is greatest on a straight and level track, it follows that the most benefit from draw-bar pull rating will be had on those roads where the ruling grades and curves are light, and, conversely, on roads having very steep grades and sharp curves, the resistance due to these becomes such a large part of the total that loading by gross tonnage only will be found quite satisfactory. To draw the line definitely, I should say that any road having grades less than 1½ per cent. would find the benefits of a draw-bar pull rating well worth the trifling extra trouble.

Framing for Box Cars.

Mr. John Kirby, for many years Master Car Builder of the Lake Shore and one of the best known of the old school of car builders, sends us a protest against the methods now most often used in designing box cars of large capacity and shows in the accompanying drawing a design of his own for a box car, 36 ft. long inside (with 6-ft. doors) with a capacity of 80,000 lbs. or more. Mr. Kirby takes exception to some of the prevailing features of the modern car and his design is intended to do away with some of them. In these days of crowded mills and car shops it is almost impossible to get properly seasoned timbers for the underframing, and when cars are built with truss rods secured through the end sill with supports under the needle-beams, the shrinkage of the green wood slackens the truss rods and allows the car to sag.

The design shown provides ample supports for the four truss rods 1⅜ in. in diameter over the bolsters and needle-



Kirby's Framing for 80,000 lbs. Capacity Box Car.

beams. The ends are flattened to 2¾ in. x ¾ in. secured to the longitudinal sills by two ⅞ in. iron plugs and three ¾ in. bolts, making a strong and simple fastening.

The side framing is particularly strong and well proportioned. Between the bolster and the needle-beams, the weakest portion of the frame in most designs, are six vertical and diagonal rods, affording ample support to the sills. The timbers are framed in iron pockets, as shown in detail, and the rods are carried through and bolted into heavy washers on the under side of the sills.

There is no startling innovation in the design but simply a combination of details, each in itself in satisfactory use, adapted to the severe conditions of modern freight car service.

Blackwell's Island Bridge, New York.

In August of 1901, page 570, we gave a detailed account, with numerous illustrations, of the great bridge designed to cross the East River, in New York, at Blackwell's Island. This bridge was designed by Mr. Richard S. Buck, then Chief Engineer (now Chief Engineer of the Dominion Bridge Company). The plans provided for a main structure 3,673 ft. long, with approaches 4,542 ft. long. giving a total of 8,215 ft. The main bridge is divided into five spans, resting on six masonry piers. The longest span is 1,131 ft., another span is 984 ft., both of these being cantilevers. The conditions for the foundations are unusually favorable, as solid rock is found in most cases about low water mark. The contract for the piers was let in the summer of 1901 for the sum of $745,547.

After the present Bridge Commissioner came into office he revised Mr. Buck's plan quite materially, reducing the width of the bridge from about 120 ft. to 80 ft. Great popular opposition was developed to the Bridge Commissioner's plan, and, finally, the Mayor of New York appointed a Commission to take up the whole subject. This Commission was composed of Professor William H. Burr, Columbia University; Mr. Henry W. Hodge, of Boller & Hodge, and Professor Palmer C. Ricketts, of the Rensselaer Polytechnic Institute. December 10 the Commissioners presented their report, which we give practically in full below, because of the magnitude of the work and because the Mayor directs the Bridge Commissioner to prepare designs on the lines proposed by this expert Commission, and hopes that the result will be accepted, in order that the work may now proceed.

. . . The questions to be answered by the Commission will be considered in the order employed in your letter of instructions:

1. How does the capacity of the bridge proposed by Mr. Lindenthal compare with the capacity of the bridge as originally planned? Is it larger or smaller or substantially the same?

The Commission understands that this question requires an answer as to the relative capacity of the two bridges to pass traffic at the proposed Blackwell's Island location, if designed in accordance with the original and the modified plans, as set before us, without regard to the further consideration whether either plan would afford too much or too little or just sufficient capacity for the traffic ultimately seeking passage by that structure.

The original plan provides for two elevated railway tracks on a deck above the roadway floor. The same provision in the same general location is made in the proposed plan. Again, the original plan provides two sidewalks on the lower or main deck, each 10 ft. wide in the clear. The modified plan provides two sidewalks on the upper deck, each 11 ft. wide in the clear; the proposed plan thus giving 10 per cent. excess of available sidewalk width over the original plan, but against this excess are to be placed the stairways at the ends of the approaches, which decrease the capacity of the sidewalks. Again, the original plan provides four trolley tracks in spaces or lanes exclusively reserved for their use. In the modified plan two trolley tracks only enjoy the use of exclusively reserved lanes, the other two trolley tracks being placed on the roadway without separation from the wagon traffic. Therefore, the capacity of the two plans, as far as the elevated railway tracks, the two sidewalks and two of the four trolley lines are concerned, is so nearly equal that they may be considered substantially the same.

The two remaining trolley tracks in the original design are entirely separated from the roadway traffic, hence the capacity of the trolley service in the original design is greater than in the proposed design, as no lines can be delayed or detained by the wagon traffic.

It is a matter of general observation throughout New York City, especially in the most crowded streets, as well as in other large cities, that the traffic in the busiest hours is never equally divided in the two directions, but that the great preponderance of vehicular movement is either in one direction or the other, according to the portion of the day in which it takes place. The accommodation for vehicles, therefore, as a class must be so provided as to meet the requirements of this greatly unbalanced movement. As a result of extended observation on the densest and most bulky traffic of the streets of this city and on the New York and Brooklyn Bridge, it may be at least approximately stated, for purposes of comparison, that availability of roadway space may be determined by dividing the roadway into lanes not less than 9 ft. wide, that width being sufficient to accommodate the widest and bulkiest trucks or vans moving in the city streets.

The roadways in the original design are of sufficient width for four such lines of wagon traffic, whereas the proposed design does not show quite sufficient capacity for three such lines, excluding the trolley tracks, which certainly should be excluded in getting their maximum capacity. As shown by the above statement of unbalanced traffic, the four lines allowed by the original design would probably rarely be used to their full capacity, yet, in any case, there will always be passageway for two lines of unobstructed traffic in one direction and one line in the other direction, and this is greater than can be secured under the best of circumstances in the proposed design.

It is thus seen that the total aggregate capacity of the original plan is greater than that of the proposed plan.

The second question which you submitted to the Commission is: 2. "Which of the two bridges is, in your judgment, preferable, taking capacity, efficiency and beauty all into consideration?"

The answer to question one fully covers that part of this question relating to capacity.

In comparing the efficiency of the designs we have considered the following characteristics: Superiority in handling traffic; the facility with which passengers may take other means of transportation in case of accident; the possibility of accident due to any arrangement of the passageways for different kinds of traffic; the attractiveness of the various lines of traffic for the purposes for which they are intended; the general arrangement of the members of the bridge trusses and floor system to insure the greatest rigidity and durability, and other conditions calculated to attract traffic of any or all kinds, or to render its passage more economical, agreeable or expeditious.

Beauty in a bridge of this magnitude is mostly arrived at by a proper arrangement of the main lines of the trusses, and harmony between the component parts of the structure; all smaller details can generally be made satisfactory on any design of bridge.

Taking the relative merits of these three features in their order we find the capacity of the original design to be greater than that of the proposed design, as answered in Question 1.

As to efficiency; it is our opinion that the trolley traffic should be completely separated from the roadway traffic, as found in the original design, so that the speed of the trolley cars shall not in the least be interfered with by the wagon traffic. We further believe that the roadway should be in one clear width, without obstruction of any kind, as found in the proposed design. In the original design, the sidewalks being on the lower deck are in the best position for taking care of the passengers in case of accident on any of the four trolley lines, but in case of accident on the elevated road it would be difficult to take care of the passengers; whereas, in the proposed design, in case of accident all the trolley and elevated railway passengers are taken care of. In the proposed design the sidewalks are shown on the upper deck, and while we believe this has advantages as to attractiveness for pedestrians it is well known that in case of great crowds stairways may be a source of danger at the entrance of such structures.

It is our opinion from inspection of the drawings of the original and proposed designs that the feature of beauty has been given considerably more attention in the proposed design than in the original and that the general outline in the proposed design is more satisfactory than in the original design. On the other hand, placing a bridge of the proposed width on piers designed for a much wider structure involves difficulties as to appearance not yet satisfactorily solved in the proposed design.

In view of the preceding statements, the Commission is reluctant to make unqualified answer to this question, not regarding either plan in its present condition entirely satisfactory. If choice were unavoidable two of your commissioners would favor the original and one the proposed design.

A plan, however, set forth at the end of this report, can be arranged which will afford more satisfactory capacity and be more efficient than either of the designs submitted for our consideration.

The third question is:

3. Which is likely to be the more expensive structure?

Your Commission made a careful examination of the plans, both detail and general, so far as they have been prepared, as well as the books in which the computations have been made and recorded. The final detail drawings of neither plan have been completed; nor have they been developed sufficiently to enable accurate estimates to be made. Such data as now exist were availed of and certain general but approximate computations of weights of steel work were also made by the Commission. These quantities of materials are affected to a considerable extent by the character of the floor employed, both for highway and trolley and elevated railways. These approximate estimates were based on the supposition that buckle plate and asphalt, or other similar permanent floors, should be used for all portions of both decks. The results of these approximate computations indicate that the difference in costs of the two plans developed on similar general lines, as to floors and other elements of design, will not be greatly different, but that the modified structure is likely to be less expensive than the original structure.

In the consideration of these questions this Commission disclaims either approval or disapproval of either of the two general types of trusses employed in the plans, or of such detail features of a purely structural character as the combined arrangement of piers and steel work above them, as lying outside the scope of the questions requiring answer.

RECOMMENDATIONS.

Having thus answered your questions, we take the liberty of making the following recommendations for the arrangement of this structure:

That two sidewalks, each not less than 11 ft. in clear width, be placed on the upper deck inside of the trusses and adjacent to them; that the two lines of elevated railway be placed on the upper deck, one on each side of the center line and as close as possible to the sidewalk; that the lower deck be arranged with two trolley lines on overhanging brackets, one outside of each truss, and with two additional trolley lines inside of the trusses, one line being adjacent to each truss; that a roadway be placed in the middle of the lower deck, with complete separation between it and the trolley lines on either side and that the clear width of this roadway between the guards shall not be less than 36 ft., and, without columns, requiring a clear width of not less than 56 ft. between trusses.

We further recommend that a solid floor on buckle plates be used on the lower deck between the main trusses, and that the lightest practicable continuous fireproof flooring be used on the sidewalks, the two elevated railway tracks and the spaces between the overhanging and the adjacent trolley tracks. The remaining portions of the overhanging trolley tracks should have an open fireproof floor as light as practicable. The central space between the elevated railway tracks should be entirely open to admit light and air to the roadway below. It is the opinion of the Commission that this material decrease in the dead weight of the floors will fully compensate for the small increase in weight resulting from the increased separation of the trusses without increasing the cost of the structure. It is further the judgment of this Commission that the capacity afforded by this plan is not beyond reasonable provision for the future requirements of the locality served by the bridge.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The railroad gross earnings for the month of November (compiled by *The Chronicle*) show seven per cent. gain over November, 1901. This is for 90,000 miles of road. For six years, now, there has been a November gain each year over the year before. Last year it was 12½ per cent. For eight years in succession the gross earnings for the eleven months to November 30 have shown gains, but for the *month*, November, 1896, showed a decrease. The steady prosperity of the railroads since 1895 has been used with consistent wisdom by the managers of those properties to put them into condition, physical and financial, to stand heavy weather, and we should think it quite safe to say that the railroads of the country were never before so strong as they are to-day.

A recent census bulletin gives the amount of power employed in manufacturing establishments in the United States in the year 1900. This is found to be 11,300,000 horse power. The increase from the census of 1890 was 90 per cent. It must be observed that this is only the power used in manufacturing, and leaves out of the account much the greatest part of the power used in the United States. If we take the number of locomotives in the United States as 38,000, and the average horse power as 1,000, we get an aggregate of 38 million horse power. This is only a rough approximation, for no one can tell the average horse power of the locomotives of the United States, but in that service alone something like 3½ times as much power is used as in manufacturing. But beyond this, there is a great amount of power used for lighting, for working street railroads and in the service of buildings. The compilers of the figures in this bulletin tell us that a canvass of New York City made by an electrical company showed that the isolated electric plants in that city make and use over 100,000 horse power. Returning to the power used in manufacturing, we find that of the total 8,742,000 horse power is from steam engines, or 77.4 per cent. of all the power. Gas engines furnish 143,850 horse power, or 1.3 per cent., and electric motors furnish 311,016 horse power, or 2.7 per cent. An interesting fact is that the horse power of gas engines increased in the decade by over 1,500 per cent. Say in round numbers from 9,000 to 144,000 horse power. The horse power of electric motors increased nearly 1,900 per cent.; that is, from 15,600 to 311,000. In the use of water power the increase was 37.6 per cent., and the aggregate was 1,727,000 horse power, as compared with 11,742,000 from steam engines. This bulletin (prepared by Edward H. Sanborn and Thomas Commerford Martin, expert special agents) contains interesting general discussions of the various projects which, perhaps, have even more value than the comparative figures which, in the nature of things, are important. The development of water power has been pushed on by the growth of long distance electric power transmission, and a table is compiled of companies engaged in such transmission. This table gives the capacity, the length of line, the voltage, and the transmission current whether two-phase or three-phase. The longest transmission line is 220 miles, the capacity of the power plant is 10,000 horse power, and the line voltage is 60,000, with three-phase current. This same company has another line 140 miles long. These are much the longest lines found in the table, although there are lines of 55 miles and 80 miles.

A remarkable situation has ended; on Tuesday of this week the aldermen of the City of New York approved the franchise for the Pennsylvania tunnel and station in that city. The little band of buccaneers stood firm to the last, indifferent to public opinion and to the interest of their city. Whether they hoped to be bought or whether they expected to make political capital we do not know. Probably for a time they hoped for both, but we suppose that they must have abandoned the hope of purchase some time ago, for the Pennsylvania Railroad Company has played an open hand from the first. Its position has been candid, dignified and resolute, and the result will be an example to other corporations. The simple conditions were laid down plainly, and were made known to the public, and there has been no retreat, no dickering and no serious concession. Within the last few weeks some of the daily press writers have suggested that other corporations might have hired an opposition to the franchise. Concerning this we talked long ago to the Pennsylvania officers immediately in charge of the matter. They refused to think of it as possible, and we have never attached any importance to it. The men who have succeeded in holding up the franchise so long are a cheap lot, and most of them could easily be bought by one side or the other, but they lack the cardinal political virtue of staying bought. None of the great corporations could afford to fool with them, even had they been so disposed, and we have never seen or heard anything to indicate that they were so disposed. On the whole, the outcome is a triumph of fine management. It would be hard to point to an enterprise of such magnitude and involving such a variety of interests and affecting so many different policies that has been carried forward to this stage in so short a time.

One Source of Rail Wear and Flange Wear.

As the reader is well aware, it is the fashion to say that the recent rails of heavy section do not give as good service, relatively to their weight, as earlier rails of lighter section. It is the fashion to say this, and so far as we get testimony it is probably true, although we are bound to say the testimony is not yet entirely conclusive. That is, when the records are brought down to absolute facts and when a considerable number of facts is collected we find that it is not so easy to decide as it is when we know less, which is not an unusual human experience. However that may be, the matter will be gradually thrashed out now before a great while. Meantime, we suggest another phase of this subject.

The Chief Engineer of a railroad which does a heavy business, concentrated in big cars and which has large percentage of curvature and grade, gives it as his emphatic opinion that the bulk of the wear and tear on rails and track is due to two principal causes: First, the great variation of speed, as a result of which counterbalancing is ineffectual, and, second, defects of construction which prevent trucks from curving freely. Weak truck bolsters, weak body bolsters, center bearings and side bearings that develop great friction are, in his mind, a much more important factor in rail wear than variation in chemistry or in mill treatment. He says it is a matter of record that trucks with this weak construction and without anti-friction bearings involve an increase of drawbar pull running up to 25 per cent. This increased pull, whether it is five per cent. or 25 per cent., is developed in pulling the flanges of the car wheels against the sides of the rails.

Perhaps this gentleman exaggerates the relative importance of this element because of the special conditions on his road which, as we have said, give a combination of heavy concentrated loads, steep grades and sharp curves. Still, it is probably true that few operating officers attach nearly enough importance to the conditions which prevent free curving of trucks. Motive power and rolling stock men do understand these conditions pretty well, but their busy superiors have seldom had the time and opportunity, even if they have had the inclination, to investigate the matter with such thoroughness as to give them an adequate notion of the situation.

We attach less importance to the matter of anti-friction center and side bearings than to the other matter of having adequate bolsters, although on a curve the load will come down on the side bearings without bending the bolsters. But on an ordinary road the load will sway from side to side at short intervals so often that the trucks will have a chance to swing around. At least, all of this is plausible theory; but for weak bolsters there is no help except to make strong ones.

The Cost of Passenger Traffic.

We have often noticed that in Europe and especially in Germany there is a much greater demand for the reduction of passenger fares than of freight rates, though average fares, taking all classes together, are much lower there than here, and average freight rates much higher; and there as well as here the ability to extend production, give employment to workmen, and distribute products among home and foreign consumers depends very much on freight rates and very little on passenger fares. It has also seemed to us that the low passenger fares in many European countries must leave very little margin over the cost of conducting the service, and so have imposed on the freight traffic nearly all the burden of the interest on the capital invested in the railroads.

This relative unprofitableness of the passenger traffic seems pretty well demonstrated by an article in the *Journal* of the German Railroad Union (Nos. 92 and 93) by Herr von Mühlenfels, based on very careful analyses of the expenses properly chargeable to passenger traffic on Wurtemberg railroads. In that country, as elsewhere in Germany, there has been a serious movement in favor of a considerable reduction in fares, amounting for the bulk of the travel to about one-third. The administration, in order that any steps taken might be reasonable, kept a careful account of the several expenses which can be separately charged to passenger and freight traffic, and divided the others on carefully considered principles, and in this way reached what is perhaps the most accurate statement of the actual cost of passenger traffic that has ever been made.

It is, of course, impossible to divide some of the expenses of a railroad between the different branches of traffic exactly; but it is not wise to assume that because we cannot know everything about a subject, we can know nothing about it. Most of our acts and decisions are based upon approximate knowledge, and the more closely we can approximate the facts, the more rational we may make the actions based on them. As a matter of fact, we make rates daily from passenger and freight services, and we usually intend that the charges shall at least cover the cost of the service.

The Wurtemberg data made possible a division of expenses clearly chargeable to passenger traffic among all the different classes of trains, and the average number of axles in each kind of train was known. Without following the division of expenses among locomotives, cars, train force, etc., as ascertained, we will here note only the total cost per train-mile, as finally calculated:

Express trains	79.22	cents
Passenger trains	61.15	"
Freight trains	93.65	"
Mixed trains	58.18	"

On this basis, the total cost of passenger service in 1899 was 13,707,000 marks; of freight service, 15,682,000 marks. The passenger earnings were 17,213,688 marks; the freight earnings 32,300,143; indicating that expenses absorbed very nearly 80 per cent. of the passenger receipts and only 48⅓ per cent. of the freight receipts, so that of the total net earnings 82¼ per cent. was contributed by the freight traffic. Now Wurtemberg pays about 3.6 per cent. interest on the capital which it has invested in its railroads, and their net earnings are barely sufficient to meet this charge.

It is, of course, possible that higher passenger rates in that country would reduce traffic and earnings more than expenses; and it would hardly be possible to advance fares. The most that can be expected from the conviction of the unprofitableness of passenger traffic is the prevention of further important reductions in fares, and the favoring of freight rather than passenger traffic when an increase in net earnings shall permit any reduction in charges. As everybody pays fares, while comparatively few pay freight bills directly, the popular pressure nearly everywhere is chiefly for lower fares.

Notwithstanding the higher fares in this country,

it is doubtful if passenger traffic is, on the average, as profitable here as in Germany. The difference between different railroads, or rather between different routes, is enormous. Probably most of the great systems have lines on which the passenger traffic yields no profit; and on some of the long lines which compete for the travel between very important cities, the same may be suspected. The aggregate through travel may be sufficient to yield a large profit; the lines which secure most of it may make a satisfactory profit; but those that have least of it have to incur the enormous expense necessary to compete with the more favored lines, for a traffic which is far from filling their palatial trains. For the passenger traffic as a whole, the fact that the average trainload in this country amounts to only 41 passengers is painfully significant. It is doubtless to a great degree a natural consequence of that other fact, that there are here less than 400 inhabitants per mile of railroad against something like 2,000 in the chief European countries, but it signifies none the less that there can be no great profit on passenger traffic under existing circumstances. That there would be less still if rates were higher may well be true. But in the nature of things, there can be no general solution of the problem. When large trainloads can be obtained, a reduction of rates may often increase profits, a determination to share, at any cost, in a much-talked-of through traffic, requiring luxurious accommodations, probably sometimes decreases them; and the loss is regarded as unavoidable. But it is always in place to fix as nearly as may be the cost of any such service, in order that the returns, in profits, reputation or what not, may not be paid for too dearly.

NEW PUBLICATIONS.

The Civil Engineer's Pocketbook. By John C. Trautwine, Civil Engineer. Revised by John C. Trautwine, Jr., and John C. Trautwine, 3d, Civil Engineers. Eighteenth edition, 70th thousand. Pp. 1,080. Leather, gilt, index. New York: John Wiley & Sons. London: Chapman & Hall, Limited, 1902. $5.00 net.

The wise and candid preface to the first edition of this famous book is dated Nov. 13, 1871, and it is well that the editors of the 18th edition preserved that preface, for it alone is "worth the price of the book." If a young man will read and read again the first two pages, and will meditate over them until he really possesses himself of the truths there stated he will have gone far in his education.

A part of the preface to the ninth edition is also retained, telling of a somewhat comprehensive overhauling that took place then. The preface to the 18th edition informs us that the book has now undergone a far more extensive revision than at any other time. More than 370 pages of new matter have been added, and the new edition is larger by about 100 pages than its recent predecessors. A few extracts from the preface will give a notion of what has been done.

"Among the new matter in this edition will be found:

Annuities, Depreciation, etc.
Logarithms.
Logarithmic Chart and Slide Rule.
New Table of Logarithms.
Conversion Table of Units of Measurement.
Isogonic Chart.
Venturi Meter.
Ferris-Pitot Meter.
Miner's Inch.
Water Consumption in Cities.
Cost of Water Pipe and Laying.
Digest of Specifications for Bridges and Buildings.
Tie Plates.
Digests of Specification for Iron and Steel.
Gray Column.
Trough Floor Sections.
Price List of Manufactured Articles.
Business Directory.
Bibliography.

"The following articles have been almost or entirely rewritten:

Arithmetic.
Specific Gravity.
Time.
Chains and Chaining.
Location of the Meridian.
Rain and Snow.
Statics.
Strength of Beams.
Shearing Strength.
Torsional Strength.
Opening Remarks on Hydrostatics.
Effect of Curves and Bends on Flow in Pipes.
Trusses.
Locomotives.
Cars.
Railroad Statistics.
I-Beams, Channels, Angles and T-Shapes.
Cement.
Concrete.
Timber Preservation.

"The articles on arithmetic are considerably extended, notably by the addition of new matter relating to interest, annuities, depreciation, etc., including several tables.

"The new and greatly enlarged table of five-place logarithms is arranged in a somewhat novel form.

"The Conversion Tables contain the equivalents of both English and metric units, and of each of these in terms of the other. The tables have been separately calculated by at least two persons, and their results compared and corrected.

"The new article on the location of the meridian is much more complete than its predecessors, and a new table of azimuths of Polaris, corresponding to different hour-angles, has been added.

"Perhaps the most radical and extensive of all the changes in this edition are those in the articles on Statics, on Beams and on Trusses. These have been almost entirely rewritten and completely modernized. Under Trusses, modern methods of calculating the stresses in and the dimensions of the several members, and modern methods of construction, are explained, and several modern roofs and bridges are described and illustrated. One of the most notable features in the new article is the digest of prominent modern specifications for bridges for steam and electric railroads and for highways. The articles on the strength of beams are greatly simplified and brought into harmony with modern methods of dealing with that subject.

"In preparing the digests of specifications for iron and steel, use has been made of the specifications recently adopted by the American Section of the International Association for Testing Materials; while those of the American Society of Civil Engineers and of the recent report of a Board of United States Army engineer officers have been similarly used in connection with cement."

A useful price list and business directory is added, as is also a bibliography. These fill 40 pages. Of course, the reader who has sense enough to ever want to use the book will know just what value to place upon the price list; that is, it will help in approximations and comparisons.

The user of the pocket-book knows how carefully it has been edited in the past, and there is no sign of any relaxation in that care. On the contrary, years and experience have added to the value of the editor's work, which has been thorough and conscientious, and in which he has been assisted by the knowledge and advice of many authorities.

Light Railways Construction. By Richard Marion Parkinson, Assoc. M. Inst., C. E. Octavo, 244 pages, 85 diagrams, no index. London, New York and Bombay: Longmans, Green & Co., 1902. $4.

The author of this book says that he has endeavored to provide a text book which, though primarily intended for those engaged in constructing light railroads, may be helpful to all who are employed on public works. In one chapter he tells of the effects of gages, curves and grades in building and working. Another chapter deals with the preparation of plans for deposit with Parliament in seeking legislation. Another chapter describes the proper ways of preparing working plans and sections. Then the various topics taken up are methods of building railroads, bridges, tunnels and station, and drainage and water supply. These topics cover six chapters, while another chapter is devoted to working steep inclines, another to contracts and specifications, and still another to measurements and estimates. A number of appendices give some detail information as to methods and structures and give also a few elementary but useful tables.

As a whole, we should say that the book will be of a good deal of use to the younger engineer, and that its usefulness will by no means be confined to the kind of railroads indicated by the title, for practically everything that is said applies about as well to railroads for heavy traffic. The treatment is quite elementary and is pretty closely confined to British requirements and methods.

The author discusses very briefly the troublesome question of the gage of a light railroad. We regret that he discusses this so briefly, for there is considerable danger that the people of England may be led astray and may build a considerable mileage of gages narrower than the standard. Mr. Parkinson thinks that the inconvenience caused by trans-shipping is overrated, but, on the other hand, he thinks that the saving possible by the use of a narrow gage is also overrated. He says that for a road built to carry the ordinary British coal wagon, with seven or eight tons on an axle and a 6-coupled, 24-ton engine, the saving in building the 3 ft. gage as compared with the standard gage (4 ft. 8½ in.) would be only from 5 to 10 per cent. A larger saving could be effected with a 2-ft. gage or 3-ft. gage with very light rolling stock. But it must be remembered that a light engine would be of little use on a heavy grade and that a 2-ft. gage would be very unsatisfactory for passenger working. We have long held that the proper policy for the English people is to build their light railroads to the standard gage. Thus they could save trans-shipping; they could divert to the light railroad a great amount of rolling stock which must soon be displaced from the existing roads, and their permanent way, piers, abutments, etc., would be in a shape to be adapted to heavy traffic, as heavy traffic develops.

Twenty-third Annual Report of the State Board of Health of Massachusetts. Secretary, Samuel W. Abbot, M.D., Boston, Mass. This report is for the year ending Sept. 30, 1901.

Those who have occasion to follow literature of this kind know that the Annual Reports of the Massachusetts Board of Health are of peculiar value. They abound in statistics and always contain excellent special reports on matters of water supply, sewerage and diseases.

American Street Railway Association. The report of the 21st annual meeting of this Association, held last October, in Detroit, appears in a pamphlet of 344 pages. It contains a number of important papers and discussions, the scope of which was indicated in our reports of the meeting at the time. The volume can doubtless be obtained from the Secretary, Mr. T. C. Pennington, 2020 State street, Chicago, Ill.

The Great Consolidations Called "Trusts."

The address which is printed below was delivered Friday, a week ago, before the students of the University of Nebraska, at Lincoln. The speaker was Peter S. Grosscup, United States Circuit Judge of the Seventh Circuit. The principles developed appear to us sound. The argument is convincing, and the whole document is an uncommonly good piece of English literature. We feel, therefore, that we are doing a public service in placing the full text of this address before our readers in such shape that they can read it more comfortably than in the smaller type of the daily newspapers, and that they may preserve it for repeated readings during the struggles which are before the nation.

It is the fashion, nowadays, to point to our place as a people, industrially and politically, among the nations of the earth; to take a just pride in the leadership acquired; and to exploit the belief that it is not only secure now, but will remain secure for a long time to come. We are told that our manufactures go to every land; that our harvesters are to be seen in the grain fields of Asia Minor; our locomotives drawing trains in Russia; our machinery bringing out gold from the mines of South Africa; our bridges spanning the rivers at Khartoum; and the Sultan of Turkey preparing to defend his sovereignty by battleships built in American shipyards. All this, it is said, is still on the rising tide, so that when the flood is reached, the United States will have become the richest and most powerful people on the face of the earth.

Her political power and influence, we are told, have kept equal pace. She is present, physically and politically, not only throughout North America, but at the outposts of the Western Hemisphere in the Caribbean Sea, and at the outposts of the Far East in the islands of the Pacific. Her views are consulted by the Cabinets of Europe, and her armies aid in keeping the peace of the world. What, perhaps, astonishes us most is that our country has thus become a chief partner in determining the destinies of mankind, within the years some of you have been in this university.

Gratifying as this outward spectacle is, it should, by that very token, lead us to inquire, How goes the life within?

During these same years, one-third or more of the industries of the United States have passed from the ownership of individuals or local corporations into the great bodies of property known as the trusts. Should the process go on until all our industries are thus consolidated, as many well-informed men now think probable, the so-called trusts will have absorbed nearly one-sixth of all the wealth, of all kinds, in the United States. Nothing in history, outside the rise of the feudal system, has left so striking a change in what may be called the personnel of ownership. As a mere right to hold and control, ownership remains, of course, unchanged, but if the process of the last few years goes on unchanged the universality of ownership that characterized our past—an ownership of our industries widely spread among the people—will be all but lost.

Accurate statistics show that the former owners of the industries now consolidated have put their money, or the bulk of it, in the banks; the workman declines to invest his surplus wages; and with them, also standing aloof, is the ordinary man, possessing ordinary means. It is certain that, as never before in our history, there are several millions of men and women brought up in the industrial trades who are now without proprietary interest in the trades they follow. No less a man than Webster said that the freest of Governments will not long be acceptable if the tendency of the laws be to create a rapid accumulation of property in a few hands, rendering the majority of the population dependent. If this be truth, it has come about that the same years that brought us riches and greatness as a nation have brought with them an internal disorder, which, if allowed to go on, will endanger the stability of the Government itself.

The men and women who, two generations ago, came over the Alleghanies into the Ohio and Mississippi valleys; the children of these, who, abiding with their fathers until wild nature had been tamed, faced wild nature again on these trans-Missouri plains; our earliest forefathers, who threw themselves on the ocean to be cast up in the wilderness; the men and women, who every year have braved something, to gain something they might call their own; these, and these alone, are the true types on which our institutions thus far have found secure foundation. It was not civil and religious liberty alone these fathers sought. The spirit of adventure does not, alone, account for the courage of their children. They sought, one and all, opportunity as well; the independence of individual ownership; the fulfilment of an instinct, born with the beginnings of property itself, and without which property would not have been. This instinct it is, that has kindled, at all times, the genius of the inventor; that makes strong the arm of the laborer; that brings companionship into the field with the farmer; that sets before us a prize, nerving our resolution to its attainment; and that, turning us aside from frivolous lives, makes us useful helpers in the progress

of mankind. Along with love of liberty, and reverence for the rights of man, this innate desire to acquire and possess constitute cornerstones in the fabric of our civil government—are, indeed, the spirit and soul of our civil institutions. And what shall it profit our country if it gain the whole world and lose its soul?

I do not expect the soul to be lost; I do not expect the tendency toward consolidation—a natural economic law—to cease; but I do expect that the present consolidations, and those that come after them, will either cease to exist or will be put on such firm ground, in matters of obedience to law, fairness in organization, honesty of management and permanence of reasonable success, that the average man and woman, who by birth or inclination seeks a place in industrial life, may safely become part owners in their securities, and in that way co-sharers in the advancing prosperity of the land. This, in my judgment, states the core of this whole vexed subject of the so-called industrial trusts.

But before proceeding to state the salient facts and reasons upon which my judgment is based, I wish, if possible, to arrive at a common understanding of what we mean by the word "trusts" and what are more or less fanciful objections to their existence. I exclude from the purpose of this discussion the railroads of the country. They may or may not be trusts; it is enough that they are commonly in mind when we think of the so-called industrial trust. Besides, the considerations that should control our judgment in their case are so different, in many respects, from those relating to the industrial trusts, that an attempt to discuss both, indiscriminately, would bring confusion.

I exclude also the large private enterprises such as department stores. The attitude of the general public toward these, though interesting, is fundamentally different from its attitude toward the so-called trusts. Large private enterprise is the legitimate fruit of the freedom of the individual—a freedom as ancient as society—a freedom that the public, even when most overheated, has never yet seriously challenged. The so-called trusts are, on the other hand, the offspring of our own times, created under corporation statutes framed by our own Legislatures, and dependent for their existence upon the continued existence of the corporate power thus given.

Nor do I seek, on this occasion, a definition applicable to trusts that would be accepted in a court of law; nor one that would meet the mind of industrial experts. My sole purpose is to meet and discuss the subject, not as it lies in the mind of the specially informed, but as it lies in the mind of the public at large.

When I was a boy, in Ohio, less than thirty-five years ago, we baked our bread on our own hearth, or got it from the town baker; the flour came from the town mill; our shoes were made by our neighbor, the shoemaker; from a loom turned by the town creek came the cloth that covered our backs; a nailmill in an adjoining town supplied us with nails and other metal implements. We were without radiators; but our stoves were made in the next county; our houses were built by the town carpenter, of lumber sawed in the town mill; on every hand was the hammering, the hum, and the bustle of the individual artisan. The community might have existed as an inaccessible island; it was so well equipped to take care of itself. Of course, beyond the circle where the earth and sky met, was the great world; but it was an almost unknown world.

The years crept away, and with them went the shops with the familiar signs. The shoemaker took down his wooden boot; our shoes came from Massachusetts. The nailmill turned a ruin; nails were now made in some far-away shop in Pennsylvania. Our wheat flour came from Minnesota; stoves gave place to radiators bearing foreign names; the saddler disappeared; the bricklayer disappeared; the man who supplied our wants was no longer the man we bowed to as our neighbor. The horizon had lifted, and out into the mist slipped our old world, and in came the great world.

All this was a step in the march of industrial development. Its results seem to you not abnormal, for you were born into the world as things now are. But in its elimination of the individual from the mechanical trades; in its change of the whole face of town and country life, in its so-called factory questions, it kindled anxieties that unsettled the confidence of your fathers, as much as our later anxieties have unsettled yours.

The change of which I have just spoken did not bring in the trusts as you understand them; but it was the beginning of the so-called trust. It created the conditions and furnished the constituents on which the trust was subsequently builded. The process we called consolidation is a continuation only of the processes that set in when our neighbor the shoemaker took down his sign and closed up his shop.

One day, early in your own times, there entered the industrial world a new kind of craftsman. Looking about, he saw that the needs of mankind were supplied from mills and factories, great and small, scattered over the land. He measured the wastes of their rivalry and the economies possible under single management. He then did a thing, simple enough in conception, though difficult to execute—he proceeded, without changing them in any other respect, to join these mills and factories, or the greater of them, into single ownerships. Not a factory was removed or demolished, not a fire put out nor a sign changed. But the new joinery, though invisible to the eye, was as effective for the purpose in mind as if all the scattered mills had been torn down and then rebuilt on a single site under a single sign.

The conception thus set on foot presented itself to the financial world in the form of stocks, preferred and common; the former theoretically covering the present value of the property, the latter the expected increase of value to be brought about by the craftsman's joinery. The old owners stepped out, except as they retained some portion of the stock of the consolidated companies. The new ownership was financed by syndicates and banks. And thus set in the development that is rapidly taking away from the people at large the ownership of the properties we call the industries of the country.

Other craftsmen came. Other workshops, great and small, without an outward sign of change, surrendered their individuality for a place in one of the great industrial families. The secret was out, the fashion set, the noise of the new carpentery was heard in the land, and the day of the so-called trusts had opened.

This was nothing less than industrial revolution, not only in semblance, but in deeper significance. Revolution always excites concern. Where—the inquiry pressed home—where will this all end? Have we come to this, that the few will be masters and the many servants? Where will I be left? Am I to be oppressed—to find still harder conditions added to those already borne as the price of livelihood? Where will it leave the artisan, the merchant, the small manufacturer, my neighbors generally? Is industrial liberty for them gone? Are they henceforth—they and their children—sentenced to hard service with no hope of eventual emancipation?

The answer to these questions was the Act of Congress of July 2, 1890, commonly known as the Sherman Anti-trust law. As interpreted by the Supreme Court, that act embodied a public purpose, unwisely formed, I think, to deal with the so-called trusts on no basis other than that of extermination—to cut them out root and branch—to sweep the lands with a decree like Herod's, that no child of consolidation should be found to have escaped.

We are now well into the thirteenth year since the passage of the Sherman act. In its means of enforcement, as well as in its purpose, the act was as comprehensive as language could make it. It withheld no power, civil or criminal, that the lawmakers thought would contribute to the complete eradication of the supposed evil. It had been preceded, in Texas, Kansas, Michigan and Maine, by State laws directed to the same end, and was quickly followed by like laws in one-half the other States, including New York, Ohio, Indiana, Illinois, Wisconsin, Iowa and the West generally. Thus, so far as enactments make law, the law, both national and State, has, for a period three times longer than it took to put down the Rebellion, been in battle line against the so-called trusts.

Have these organizations been extinguished? Has the trust idea abated? Let me answer by calling but a partial roll of those organized since the Sherman law went into effect. There is the American Window Glass Company, created in 1895, five years after the Sherman act. There, too, is the Continental Tobacco Company, 1898; the Tin Plate Company, 1898; the Amalgamated Copper Company, 1899; the American Radiator, 1899; the National Salt, 1899; the International Plate Glass, 1900; the International Salt, 1901; the Consolidated Tobacco, 1901; the United States Steel, 1901; the Corn Products, 1901, and many others that come readily to mind. An inspection made for me of a list of 112 of the leading so-called trusts in the United States shows that all but thirteen have been created since the passage of the Sherman act.

May we not, confronted by such a spectacle, pause to inquire if this method of dealing with the so-called trusts—this policy of extermination or nothing—is, after all, on solid ground? Can a development so persistent be entirely unnatural? Can we by law of Congress successfully repeal what appears to be a fixed law of industrial economy? Is this instinct of the time, properly safeguarded, really in conflict with the public welfare?

It is urged sometimes that the consolidation idea, when fully attained, will make harder the conditions of ordinary life. Is that true? If true, the indictment should stand. But I can only judge the future by the past; and, seeking some specific analogy, I know nothing in the past so nearly analogous as the beginnings and growth of the railroad systems of the country.

Railroads began as small local enterprises. In the start they were the steam highways between neighboring towns and cities, resembling in that respect the present interurban trolley systems. For example, what constitutes now the trunk line of the New York Central, from New York to Buffalo, was, originally, seven or eight independent lines; one between New York and Albany; another from Albany to Schenectady; another from Schenectady to Utica; another from Utica to Syracuse; another from Syracuse to Canandaigua; another from Canandaigua to Rochester; and still another from Rochester to Buffalo. The time was when their consolidation was thought both impracticable and unwise. Laws were passed to forbid it. Public opinion was against it. But one day, under a hailstorm of public anathema, a hand reached out and, gathering up the local roads, joined them in a single road reaching from the sea to the Lakes. Then the idea took root elsewhere. One by one the roads were consolidated, the shortest lines becoming the trunks and the adjacent lines the branches; until, as they exist now, a single railroad carries us from Chicago to New York, another from Chicago to New Orleans, others, from Chicago to every point on the Pacific Coast; and at rates, both for passengers and freight, less than are charged by any railroads in the world. Who of this generation would now go back to the railroads of our fathers? Who, except the irresponsible agitator, stops to question even the private fortunes picked up in the process of consolidation? Who, indeed, looks upon the railroad system, thus consolidated as other than the normal state of such affairs—the necessary and beneficial outcome of railroad evolution?

This is a specific instance, but, wherever we turn, in the survey of development under economic law, it will be found that mankind has always been helped. There are men now living who were alive when the Duke of Wellington was the first citizen of the world. They have lived through the individual changes, many of them bitterly opposed, out of which have come the present day conveniences of life—conveniences that in the matter of substantial comfort give to the well-paid American workman more than the Duke himself possessed. The Duke had finer mahogany and better plate; sessed. The Duke had finer mahogany and better plate; but the breakfast table of the American has fruits and cereals, meats and coffees, that all the ships of England could not have gathered for her great soldier. The Duke had robes and sashes such as the American perhaps has never seen, but in the quality that gives comfort the Sunday suit of the American surpasses any clothes the Duke put on. The Duke had all England to choose from in the selection of his dwelling. He built it in a public park—a park free alike to the eyes and feet of the commonest Englishman—a park not surpassing in beauty those of a hundred cities in America; not the equal of the natural landscapes that by rail or street cars are open every hour of every day to him who has eyes to see and a heart to enjoy. We are all heirs, in almost equal portions too, not only to what God has given, but to what the genius of mankind can add.

It is sometimes urged that the growth of the so-called trusts shows a tendency to lessen wages. On the contrary a paper prepared by Prof. Jenks, and issued by the Department of Labor in July, 1900, shows that wages in general had in 1900 reached and in some cases passed the former high level of 1892, and that the wages paid by the so-called trusts were not exceeded by those paid by the large private manufacturing corporations. I think it can be fairly added, from a study of the tables furnished, that the wages paid by the so-called trusts are, in fact, larger than those paid by private enterprises. Since 1900, wages have been still further advanced, while the hours of toil have been lessened.

Perhaps the chief objection urged is, that the consolidation idea increases the cost of living. The cost of living has unquestionably increased; and it is but natural to put the blame on the most likely culprit in sight. But let us look again at the facts. I go to the bulletin of the Department of Labor for March, 1902, to find a comparison of prices between 1901 and the average preceding ten years. In clothes there was an average increase of but two-tenths of 1 per cent.; in foods of 5 per cent.; in metals and ordinary implements 10 per cent.; in house furnishing goods 10 per cent.; and in the other ordinary commodities about the same proportion.

But let the increases be what they may, the question is not, have prices advanced; but, have they advanced to figures that individual manufacturers would not, under the law of supply and demand, have exacted? My own belief is, that under the increased consumption always attendant upon the coming on of good times, prices would have gone up fully as much, and perhaps more, under the old system of individual manufacturers. Indeed, in one of the largest of our industries, as well-informed men know, prices have been kept down, by a so-called trust, as a matter of business policy. The motive, of course, was to discourage the coming in of competitors, as well as to equalize consumption, but the effect is, none the less, smaller prices to the public than individual manufacturers would have exacted.

But, take the argument at its worst, and assume that certain trusts have put up prices. What then? Should all the so-called trusts be exterminated, because here and there one has offended? Should the wheat be destroyed with the tare? Why not—here as elsewhere—apply to the offender, and to him alone, the correctives of the law? I see no obstacle, myself, in the way of effective legislation, or of effective execution of the common law, that will adequately protect the public against prices that are artificial—prices made possible, either by a cornering of the supply, or by conspiracies in restraint of competition.

We often hear, as an objection, that the capital of the so-called trusts is large; that such concentration of capital, in one control, unsettles our conception of what a single individual may own; that, as in the case of one of the so-called trusts, its fiscal transactions measure, in volume and importance, with the fiscal transactions of the Government itself.

To my mind this is largely an inherited bugbear, brought over from the days of smaller things. We live in an age of large things. If we wish to go back to

the day of small things, we must be prepared to put up with the inconveniences and limitations of those days.

In the nature of things, great enterprises must be under a few controlling minds; and, I may ask, who so worthy of power—here or elsewhere—as the man who, by sheer buoyancy of talent, has come to the top? By what safer guide could the controlling hand of a great industry be selected? Whom, for instance, could the 27,000 men employed in the establishment of the late Philip Armour have found so well equipped by experience and genius to direct their establishment? What would have been the outcome, had the owner of that establishment turned it over to his employees, to be their own in equal parts, and managed thereafter as an industrial democracy? Set apart to some work for mankind, we all are; and though some rise to an ownership and responsibilities that appear vast, they are in the last analysis trusteeships only—trusts that can not be resigned unless the power that goes with them is also relinquished.

But though the objections reviewed be untenable, it does not follow that the so-called trusts, as they now exist, are without menace to our welfare. Indeed, the real danger, as I have already indicated, lies deeper than any consideration of prices charged, or distrust aroused. It goes to the foundations of our society as a republican people. Unless, by timely and courageous measures we undo the danger, the danger will, in my judgment, go far toward undoing us, and our present institutions.

When the baker sold out his business to the Biscuit company, he invested little, if any, of the purchase money in the Biscuit company's securities. He did not purchase another bakery. Having deposited the larger portion of his capital in some bank where it drew a small but steady interest, he remained, in most instances, an employee of the purchaser. So with the tanner, who sold to the Leather company; the cigar maker, who sold to the Tobacco company; the sugar manufacturer, who sold to the Sugar company; the whole scattered legion of individuals, whose holdings have been swallowed up by the great concerns. A table prepared by the United States Bureau of Statistics shows the deposits in the banks—national, State and savings banks—by the people of the United States to be now in excess of $8,500,000,000. This is the sum of money that the people of the United States, including those who were the former individual owners of our industries, deem it better to loan, than to invest. It is equal, almost, to one dollar in nine of the whole remaining wealth of the United States. It exceeds, by $1,000,000,000, according to a recently prepared table, the combined par value of the principal stocks listed on the New York Stock Exchange, including railroads, street railways, express companies, gas and electric light companies, telegraph and telephone companies and the so-called trusts. It is nothing short of amazing that a property-loving people like ours, could have so much money left over, after having made all desired investments.

But the significance of the fact is not yet fully stated. Twenty years ago the moneys thus deposited were a little in excess of $2,000,000,000. By the growth of population and of wealth, there would, of course, be a corresponding normal increase in the people's bank deposits; but neither wealth nor population has grown at anything like the pace taken by the deposits. In the ten years following 1880—a period during which wealth and population had increased possibly 25 per cent.—the deposits had doubled. In the ten years following, they have doubled again; three-quarters of the accretion—or more than $3,250,000,000—being added since 1897.

These figures show, of course, that as a people, we have been prosperous—that the farmer, the merchant, the workman, have as never before, had out of their earnings a livelihood and a large sum over. But this does not explain it all, or nearly all. The men of this day are not less keen than those of yesterday to make good bargains, to increase their possessions, to share in the advancing prosperity of the land. They know, too, as well as did their fathers, that it is not from idle capital, but from invested capital, that any increases must be looked for. They stand aloof, it is plain to me, not from lack of wish, but from lack of desirable opportunity. It means, if it go on, that the people at large will cease to be proprietors in the industries of the land, and in thus ceasing, exchange the active interest of proprietorship for the idle curiosity of the bystander.

A widespread withdrawal, by the people at large, from general ownership in the properties of the country, cannot but be fraught with the gravest dangers. A few of these are so obvious that I need only indicate them. Such withdrawal will diminish, if not destroy, popular interest in national prosperity; for, from those only who have a stake in prosperity, can we expect great interest. It will kill off competition; for the competitor of the trusts must itself be a trust, and there will be no independent field from which to recruit the means to create such competitor. It will discourage still further the wage earner, in any hope of becoming part owner; and thus deepen and widen the existing gulf between wealth and labor. It will sap to its foundation the real strength of government; for government must be built on the interests, as well as the affections, of the people governed. An industrial system subject to such indictment is a rising menace to free government itself.

The remedy, in general terms, it is not difficult to state. The first thing to do is to abandon the present policy of outlawry and extermination. That policy has failed. It has failed through conditions that cannot be removed by law. Replace the old policy by a new, under which industrial corporations, subjected to restraint, against artificial prices, will be made, in organization and management, to invite, and worthily invite, the confidence and copartnership of all the people of the country.

To suggest concrete legislation is perhaps more difficult. It should include the repeal of the Sherman act. Logically and impartially enforced, that act forbids two grocers, on opposite corners of the street, from forming a copartnership to save expenses; partially enforced, it puts the industries of the land at the mercy not of the law, but of the officers of the law.

The legislation that replaces it should provide against artificial prices, brought about either by a cornering of the supply, or by conspiracy; and also against discrimination in prices as to either buyers or places, except as affected by actual transportation rates. There should be a provision for open books; for stated examinations by some department of the Government and for periodical statements to the public, as in the case of national banks, and many of the railroad companies.

The new legislation should forbid the issue of primary stock in excess of the cash paid in, or the real value of property contributed, to make up the company's assets. Some department of the Government should be charged—as between the company and the public—with the duty to see that this limitation was enforced.

Provision should, of course, be made for further issues of stock as the value of the property increases; but such issue as is based not on subsequently acquired property, but upon increased value due to management and operation, should be secondary, always, to the first, and should be put out only after judgment, by the appropriate department, that it was justified by the earnings and standing of the company.

To the extent that such subsequent issues represent increased value, due to management and operation, I would encourage, by every feasible method, its division in fair proportions between those who have furnished the capital, and those who have done the work. I would embody the basis of such division in the contract of incorporation, so that it would operate as a contract right, and not as a mere bonus. Experience has shown that there is no way to so satisfactorily mitigate the struggle between capital and labor, and none so just as a fair division of the harvest after both the reapers—capital and labor—have each had their reasonable hire.

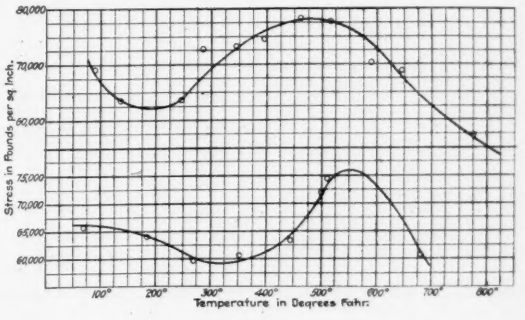
A programme such as this is not, in my judgment, either radical or impracticable. It will be opposed, however, by those who look upon corporations of any kind as a menace to public liberty and by those who look upon restraint of corporations of any kind as an invasion of industrial liberty. It will be opposed by the men who are temperamentally apprehensive, by the men who believe the present good times to be due to present conditions and deplore interference, and by the men who still wait their opportunity to get rich out of present methods of trust organization. It will be opposed by those who have given to the subject no study, by those who are incapable of giving it a candid study, and by those who thrive in practising frauds on public opinion. It will fail until public opinion is reached and educated. But public opinion will, in the end, be reached and educated. It will be made to see that a country is not made great by becoming rich; that a Government is not secure whose sole policy is to realize large dividends to capital and a large wage to laborers and to keep the peace between them; that there must be found firmer depths than these for the foundations of permanent security. We will then begin, in reality, to rebuild the industrial edifice—a new edifice made necessary by the change of time—but on the old foundations. We will anchor it, where our fathers anchored theirs, in a general proprietorship, so widely spread among the people and thus securely buttressed against hate and envy that time and change will thereafter dash in vain against the security of the State.

The Effect of Temperature on the Tensile Strength of Cast Steel.*

We present herewith a diagram plotted from the results of a number of tests, made for the purpose of determining the effect of temperature upon the tensile strength of cast steel. Inasmuch as during the past five years the use of cast steel has become general in locomotive construction, it is thought that the results will be of considerable interest.

The specimens used in these tests were about 9 in. long and ¾ of an inch in diameter. The specimens after being fastened in the testing machine were enclosed in a two-part box. A thermometer was inserted in a cup in one side of the box for taking the temperature. The lower end of the specimen was packed into the box, and the heating substance poured in from above. At first, lard oil was used for temperatures up to 600 deg., but this substance was, in the later tests, displaced by sand previously heated over Bunsen burners.

In the diagram the horizontal scale represents temperature in degrees Fahr., and the vertical scale, stress in pounds per square inch. The two curves represent different grades of steel, and it is interesting to note that in both cases the general characteristics are the

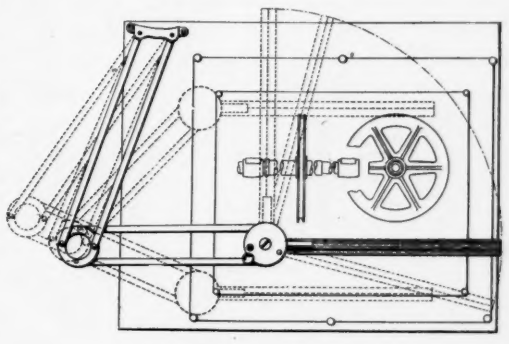


same. In the lower diagram the tensile strength gradually decreases until 300 deg. is reached. From this point the strength increases at a greater rate up to 550 deg., where it is a maximum. From this point the strength again decreases as the temperature increases. The upper curve shows a maximum stress of 78,000 lbs. at 475 deg., and the other 76,000 lbs. at 550 deg. Beyond these two points the strength falls off as the temperature continues to rise, and at points from 700 deg. to 775 deg. the strength is much lower than at the atmospheric temperature of 70 deg. It was also found that the ductility in per cent. varies in an opposite way to the strength. Another peculiarity is the character of the break in the test piece. At the lower strength the break is of an ordinary nature, being along a plane perpendicular to the axis of the specimen, but in the higher part of the curve the metal shears in two along a plane at about 45 deg. to the axis.

*From a thesis on "The Physical Properties of Cast Steel," by Messrs. C. C. Schrott and G. H. Case, candidates for the degree of M. E., Sibley College, Cornell University, June, 1902.

Rapid Sketching Device.

A device designed to enable draftsmen to make sketches and small drawings with greater rapidity than that usually attained with T-square and triangles has been brought out by the Universal Drafting Machine Co., Cleveland, Ohio. Reference to the accompanying illustration shows the device to consist of a scale, a protractor and an arm composed of two pivoted parallelograms which is fastened to the upper left-hand corner of the drawing board.



A Rapid Sketching Device.

The scale may be moved through 90 deg., the limits to this motion being imposed by two stops fastened to the protractor. The latter may be turned so as to bring the stops to any desired angle with the horizontal or vertical, permitting the scale to be swung to this angle or 90 deg. from same. The arrangement is such that having set the protractor to a desired angle it may be moved to all parts of the board and the scale will give parallel lines on the drawing.

A thumb-screw clamps the protractor and permits rapid changing of the angle. However, for the 0, 30, 45, 60 and 90 deg. angles there is a spring stop, which may be lifted and dropped into a hole at any one of these angles. The device permits the use of a triangular or flat scale, the scales chucking into place and being arranged to turn any edge for use.

The joints are hardened and ground, the expectation being that with the service required of them they will last indefinitely. The finish of the metal parts is dull nickel except the rods, which are coppered and oxidized.

Telegraph Accident Report.

At the November meeting of the Iowa Railway Club the principal discussion was on a paper, by Mr. Gordon, on the Ideal Accident Report. The speaker proposed the following form of a message from the conductor to the chief despatcher:

Train No. 74 has 5 loads and 3 Mtys derailed on fill two and one-half miles east of Scotland.

Two cars lumber crosswise of track, three cars brick turned over, fouling main track.
Three Mtys clear of main track down embankment.
Sixteen cars east and 7 cars west of derailed cars.
Want wrecker to clear track, which will take about 3 hours.
Need 50 ties and 4 rails.
Brakeman Jones, in jumping from train, was caught by a derailed car and has left leg crushed. Left in charge of Dr. Brown.
Accident caused by broken flange.
.....Conductor.

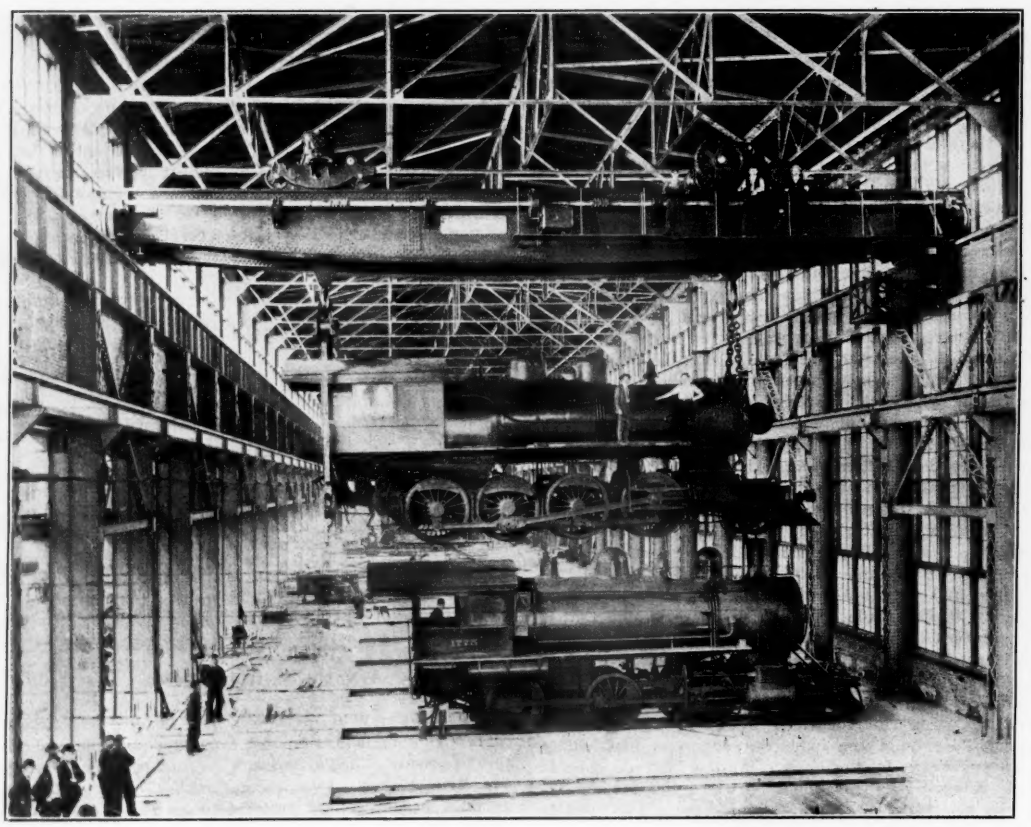
The following list of questions, which was presented, appears to have been copied from one in use on the Chicago, Milwaukee & St. Paul.

Telegraph accident report.

.....Station, Date .....
Train .....Conductor .....Engineer .....
Fireman .....Engine No. .....Brakeman .....
Baggageman .....1—Nature of accident .....
.....2—Place of accident (In cut on fill or on level) .....3—Time accident occurred .....4—Cause of accident .....5—If any person injured give Name, Address, and extent of injuries. What done for injured person (If employee state occupation). 6—Is main track blocked .....7—Can trains be moved around the obstruction? If so by using what tracks? .....8—How many cars each side of derailed cars .....9—How many cars derailed, give number, Initials, Contents and position of each with approximate damage to each car and contents .....
.....
10—If Eng. is off track or damaged state position and damage .....
.....
11—Will wrecking train and derrick be needed? If so from which end can it work to best advantage.....
.....
12—How many, what kind and capacity of cars necessary to transfer freight .....
13—Is track torn up....What will be needed to repair.....
14—How long will it take to clean the track.....
15—Can track be laid around wreck.....If so how many feet of track will be required.....
16—Give any information not contained above.....

Electric Traveling Crane at the Collinwood Shops of the Lake Shore & Michigan Southern.

The accompanying engraving shows a 100-ton 8-motor electric traveling crane recently installed by the Niles Tool Works over the erecting pits of the Lake Shore & Michigan Southern shops at Collinwood, Ohio. It is shown lifting an 80-ton consolidation locomotive and



Crane Lifting 80-Ton Locomotive—Collinwood Shops.

is in this respect a good example of an important feature in modern shop design, viz., the use of independent erecting pits served by electric cranes.

The crane is a Niles standard design fitted with two 50-ton trolleys. The main hoist motors are each 45 h.p., and are capable of hoisting the full load at a speed of about 10 ft. per minute. The crane traverses the 539 ft. of the shop at the rate of 150 ft. a minute with the full load and at 200 ft. a minute with a light load.

The bridge has a span of 65 ft. 6 in., and is the Niles standard box-girder construction and is fitted with eight truck wheels running in heavy steel truck frames which are riveted to the box-girders.

The hoist is supplied with an automatic safety mechanical brake which controls the load at all times and prevents it running down unless the motor is revolved by power in the lowering direction. The armature of the hoisting motor is supplied with an automatic electric brake, and connected so that it is "on" when there is no current flowing through the motor. This brake aids the mechanical brake in stopping the hoisting mechanism, and also will sustain the full load of the crane should occasion demand.

All gears on this crane are cut from the solid and are run in oil. The motors are designed especially for crane work and are wound for 220 volts direct current. Each motor has its own reversible controller and rheostat.

The Oldest Railroad Company in the World.

The traveler who leaves Plymouth for London by the Great Western Railway will notice, when he has proceeded 2¾ miles and is passing the 244 mile-post from Paddington, that the train crosses a single line of railroad almost at a right angle, on the level. Such a circumstance is sufficiently rare in this country to attract the attention of anyone interested in railroad matters. To it immediately succeeds an over-bridge and then, on the left hand or "off" side may be seen the single line in question, laid upon rough stone blocks but presenting a decidedly out-of-date appearance. Perchance a train of four or five little trucks loaded with square lumps of china clay and drawn by a couple of horses may be seen, but in half a mile the old line trends away northwards and is lost sight of. It belongs to the oldest railroad company in the world.

The Plymouth & Dartmouth Railway was incorporated on July 2, 1819, for "making and maintaining a Tramroad or Iron Railway for the Passage of Wagons and other Carriages" from Crabtree to near the Prisons of War on Dartmoor. These prisons had been erected about 10 years before, on the loneliest and wildest tract of land that could be found, to accommodate the French prisoners of war who inconveniently crowded Plymouth Sound in hulks. The projector of the line, however, Sir Thomas Tyrwhitt, had a great idea that Dartmoor was capable of cultivation.

The line was to have started from near the level crossing just mentioned, but the depth of the Cattewater there being suitable merely for barges, and at high water only; an Act was obtained on July 8, 1820, for commencing at Sutton Pool, the old commercial port of Plymouth, and the spot whence the "Mayflower" sailed in 1620. The far end of this extension now belongs to one of the great railroads, the china-clay traffic being shipped at a wharf against the Laira bridge, between Plymouth and Crabtree. This traffic, which is practically all there is on the P. and D. R., comes on to it by a branch at Lower Crabtree, very shortly after the line parts company with the Great Western. Of this branch, more anon.

From the junction against the Rising Sun Inn at Lower Crabtree stretches northward the deserted and grass-grown single line of the Plymouth & Dartmoor Railway. A more uniquely interesting bit of early railroad construction will not easily be found. The embankment is only wide enough for one track on the top, and has its sides made very steep and faced with stone for some distance. After a stretch of cutting a tunnel 620 yds. long is reached at a place called Leigham. The writer ventured through, but found it a somewhat trying passage, from the darkness and the pools of muddy water. No shafts exist, nor are the walls lined. Hinges for gates remain at each end, the object being to prevent cattle straying in. There would be no room to pass them, the tunnel being only 8 ft. 6 in. wide, and a foot more in height. A little further on the rocky hillside has been removed to make room. The scenery then becomes romantically beautiful, the line passing through deep woods for several miles, with the river Plym at the bottom of the glen. Most extraordinary zig-zags are made to follow the hillsides and avoid earthworks. Often the line runs in a narrow lane, with thick hedges on each side, the rails being frequently invisible from over-growth of grass and moss. Near the 11-mile post the woods end, and bare-bleak downs succeed, across which the line is unfenced but quite traceable and perfect. At about 14¼ miles it ends with absolute abruptness at the edge of a cutting in which lies the Tavistock branch of the Great Western Railway. The rails are here pulled up and lying about in disorder. Such a singular termination is due to the fact that the remaining 11 miles of the old line, up to its end at Princeton, on Dartmoor, were purchased by the G. W. R. R. and opened for traffic; as a sub-branch from Yelverton station on the Tavistock line, on Aug. 11, 1853.

In the disused part of the P. & D. R., at least six different kinds of rails may be found, often mixed up in the most singular manner. Two kinds are the original cast-iron parabolic, or fish-bellied edge-rails, the ends meeting in very small chairs only 4½ in. high. Some of these rails have ordinary butt ends, others notch ends, so that two rails meet with a half-lap joint. The notch is 2 in. long at each end, making the rails 34 in. long between the bottom of the notches, or 38 in. over all. Two kinds of chairs are used, one having oval spike holes in the foot. These spikes are virtually large horseshoe nails, evidently forged by hand, and in their wasted condition are 1 in. by ¾ in. at the top, tapering down to barely ½ in. by ⅛ in. and 4½ in. long. The lightest of these rails are only 4 in. deep at the center, but others are 6 in. deep and 4 ft. long. Numbers of them are lying about broken by the heavy loads of granite. The wrought-iron rails comprise two sections of flat-footed rail, about 38 and 53 lbs. per yard respectively, and two of bridge rails. Of these the lightest is only about 45 lbs. per yard, and may be identical with those laid on the Great Western at its first partial opening in 1838. The other bridge rail is of a very rare, if not unique type, being solid, or without the hollow beneath constituting the "bridge." It weighs about 60 lbs. All these flanged rails are of such width that the bolt holes correspond with those in the stone blocks, originally made for the chairs. Occasionally a sort of sleeve or socket to receive two rail-ends is used, spiked down through holes in the usual way. Blocks of blue slatestone, 18 in. to 2 ft. sq., form the ordinary sleepers, but smaller stones without any attachments are sometimes packed between them, forming a continuous support and helping to stiffen the rails considerably. The gage is 4 ft. 6 in.

A very curious feature of the line is the granite siding, the rails of which are of granite. Unlike those of the neighboring Heytor line (described in the *Railroad Gazette* of July 21, 1899), the wheels ran upon the inner, not the outer side of the long stone blocks, the outer part being rough-picked to below the dressed part which serves as the rail. At least four of these granite sidings remain, between the 10 and 14 mile-posts, the sidings lower down having iron rails. The points and crossings are of cast-iron, the crossings also having a movable tongue. One of the granite sidings is near the 12-mile post, close to a stone-built barn, where a public breakfast was given by Sir T. Tyrwhitt at the opening of the greater part of the line on Sept. 26, 1823. The last two or three miles of the upper end were completed about 1825, the total length of the line, from Princetown to Sutton Pool, having been originally 25¼ miles. It has a very steady rise of 1 in 100 from Crabtree, getting up to over 1,200 ft. above sea in 23 miles. The rest is about level.

Mr. William Stuart, Superintendent of the Plymouth breakwater works, was the original engineer of the P. & D. R., but it was finished by Roger Hopkins, a West Country mining engineer of some repute in his day. The upper terminus is only about 10 miles west of the Heytor quarries, but on the opposite side of Dartmoor.

Financially the line was a total failure, although said to have cost only £66,000 to build. The contractors had to take a mortgage of it and remained unpaid for many years. In the forties they worked both this line and the Heytor, leasing the quarries near the termini. Small four-wheeled wagons were used for the granite traffic in general, but for extra large blocks a platform was fitted upon two such wagons. A good deal of the outer covering of Plymouth breakwater consists of large blocks, brought down by this primitive line. Dartmoor granite, however, is not now used, being unable to compete against quarries nearer the sea.

The branch from Lower Crabtree, still in use, goes eastwards, crosses the River Plym on a curious bridge of two cast-iron arches, and entering the Saltram estate strikes northward up the valley through highly picturesque scenery. It ends at Cann Quarry. Not granite, but slate and paving stones are produced here, though little is now got out. In fact, a single large truck, drawn by a horse, suffices for the traffic. The last half-mile of the branch, which was made about 1825, and is some 2½ miles in length, remains exactly as it was first laid, with little notch-ended, fish-belly rails, more like fire-bars than rails. At a place called Plym Bridge (not where the cast-iron arches are) a private line, made in 1854, runs off to Lee Moor china clay mines, about 3½ miles distant. A self-acting incline of considerable length, rising towards Lee Moor, forms its commencement. From Plym Bridge to Crabtree the branch was relaid about 20 years ago with light iron rails of single-headed, flat-foot section, fixed to cross-

sleepers, but the stone blocks are still down between the latter.

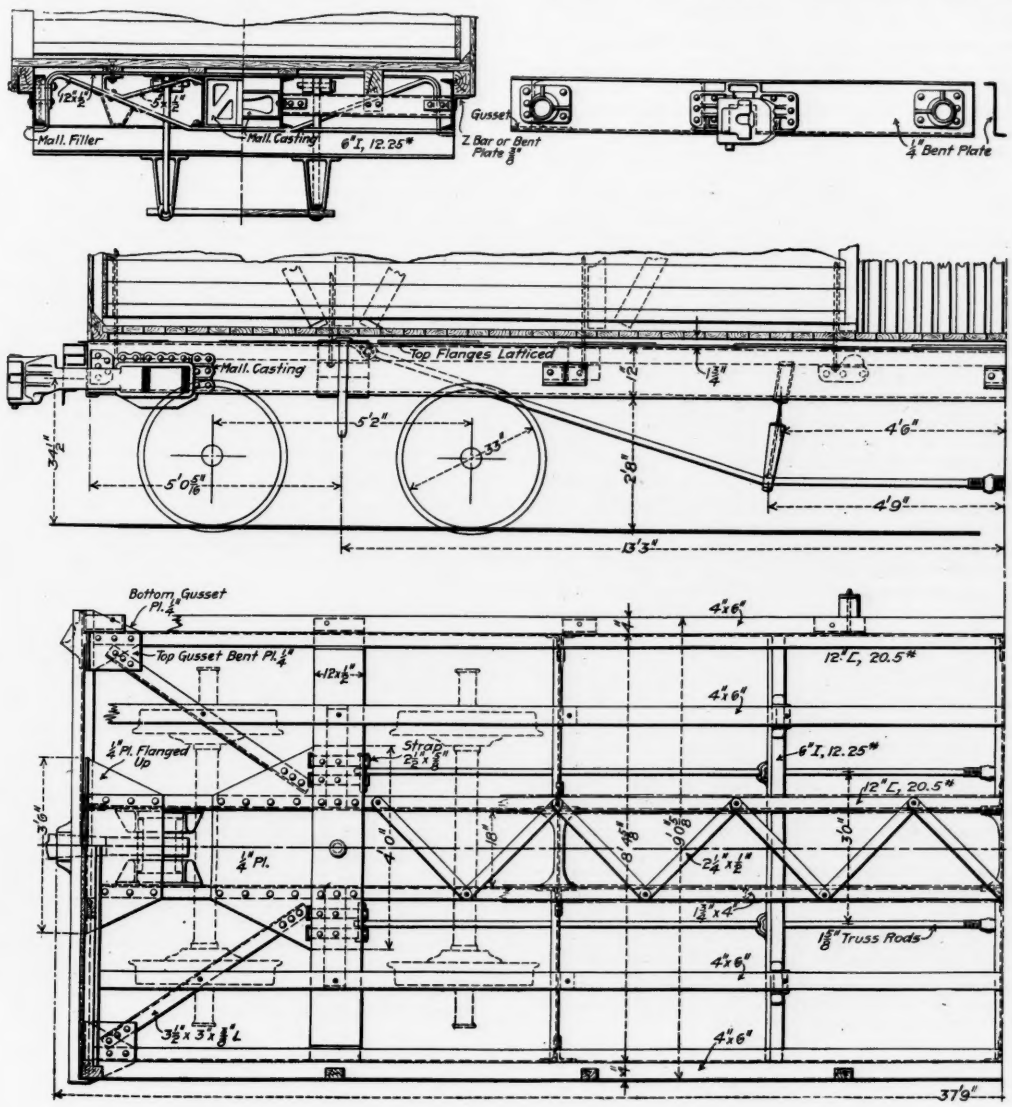
The Plymouth & Dartmoor Railway Company was dissolved, and re-incorporated, by an Act of 1865, for the purpose of bringing it under the provisions of modern Acts as to using steam power, etc. The old rates were revised and power taken to carry passengers. It then owed £75,000 to the mortgagees, Messrs. Johnson, who released it on being paid in shares. The company has since constructed some local lines near Plymouth, which are worked by the Great Western and the London & South-Western, in fact, it is virtually a joint line now. Still, though it owns no rolling-stock, it has nominally an independent existence, receives its rents, maintains a London office, and may undoubtedly be considered the oldest railway company in the world.

W. B. PALEY.

LONDON, S. W., June, 1902.

A Structural Steel Underframe for Freight Cars.

The accompanying engravings show a structural steel underframe for freight cars designed by Mr. George I. King, of the Middletown Car Works. With slight modifications, the design shown, which is intended for an American Railway Association standard 30-ton box car, may be made applicable to almost any class of freight equipment whether flat, box, gondola or stock car. It



Structural Steel Underframe for Freight Cars.

is extremely simple and damage may be repaired with the least expenditure of time and money. The use of standard structural shapes does away with delay in obtaining special shapes in case of serious damage to important members.

It will be noted that truss rods extending from bolster to bolster are used to help support the frame at the middle of the car. This feature has been criticised as undesirable in an all-steel frame, but it would seem that for equal strength a trussed stringer is lighter and therefore cheaper than a continuous rolled section. By the arrangement of rods, ample wheel clearance is provided and they are so far inside the rail lines that there is little likelihood of their being damaged by obstructions on the tracks. If the rods were used under the side sills, they might be open to just criticism.

The end sill is a ¼ in. plate flanged outwardly at the top and inwardly at the bottom. The usual malleable iron push pole pockets and striking brackets are riveted to the end sill, using the sill connection rivets for this purpose. None of the gussets on the top flanges of the longitudinal sills are attached to the end sill. This permits the easy removal of the end sill in case of damage and makes it unnecessary to take off any of the wood superstructure if a new end sill were needed. The end gussets at the center sills are flanged up and the corner gussets on the top flanges of the side sill are also flanged up, forming a shoulder for the wooden subsill and preventing the bulging of the car end by a shifting load.

No rivet holes are punched in the bottom flanges of the side and center sills, connections such as cross-ties being made by brackets riveted to the webs of these sills. On account of the compression induced by the truss rods, the center sills are latticed; although top and bottom cover plates might be used to stiffen the sills.

The bolster is quite simple and amply strong. Similar bolsters have been used on 1,000 40-ton coal cars recently built for the P. & R.

The use of side sill brackets made either from Z bars or bent plates is an interesting feature. These are used to support the side nailing strip, one bracket being used under each post and forming a washer for the sill and plate rods. The Z bar forms a pocket which securely holds the nailing strips in place and prevents its moving sideways through failure of bolt connections.

TECHNICAL.

Manufacturing and Business.

The American Blower Co.'s heating apparatus is to be installed in the Lake Shore-Rock Island Depot at Chicago.

Samuel W. Griffith has been appointed Assistant Purchasing Agent of the Lorain Steel Co., Johnstown, Pa., succeeding Geo. P. Suppes.

The Edgar Car Lock & Seal Co. is now furnishing the Quincy, Omaha & Kansas City R. R. with the new locks, seals and corners which it makes.

The Sharp journal box, made by the Holland Company, Chicago, has been specified for the 800 Armour box cars now being built by the American Car & Foundry Co.

J. H. Harden, who has been General Manager of the Anniston, Ala., plant of the Southern Car & Foundry Company for some time, will relinquish his position on Jan. 1.

A new factory will soon be built by the Kalamazoo Railway Supply Co. It will be 60 x 400 ft., and will more than double the present output. The capital stock has been increased.

The Q and C Company shipped this week, from its factory at Chicago Heights, one of its largest special metal sawing machines to the United States Government to be used at the Cavite Navy Yard at Manila.

A charter has been granted in New Jersey to the Electric Railway Safety Appliance Co., which will make an emergency brake and other devices for electric railroads. The incorporators are C. B. Fairchild and G. W. Linch, of New York City, and John H. Robertson, Yonkers, N. Y. The capital stock is $100,000, and the existence is perpetual.

The Cleveland Cliffs Iron Company is about to install an electric power distribution system for operating mixers and blowers in its Gladstone, Mich., plant, and at the Pioneer Iron Works at Marquette. The apparatus was purchased from the Westinghouse Electric & Mfg. Co. The company has also ordered a Baldwin-Westinghouse electric locomotive to be used for shifting cars in its yards.

The American Sheet Steel Co., of New York, is making a reversible metal lath. It is claimed that they are best suited for inside plaster or outside cement construction and especially where ceilings or walls are to be decorated. They have been used in such buildings as the library of Congress and the Boston Public Library. The Pennsylvania Railroad station at New Brunswick, N. J., is covered externally with cement over metal laths.

Daniel W. Pedrick is no longer connected or interested in any way with the Pedrick & Ayer Co. His entire time and attention is now given to H. B. Underwood & Co., of which firm he is the senior partner, and he has also been a partner of this firm since its organization, and is turning out portable cylinder boring bars and other portable tools for railroad repair shops.

The White Enamel Refrigerator Co., St. Paul, Minn., is equipping its factory (recently bought) with electric light and power and steam heat. The building is on a tract of 23 acres at Medway, between St. Paul and Minneapolis. The building is approximately 191 x 267 ft. and is being remodeled to suit the wants of the company. There is also being put up a warehouse 64 x 200 ft. Shipping and receiving will be done on the Minnesota Transfer where all of the roads of the northwest center. The office of the company in St. Paul has been removed from 409 Jackson street to 13 East Sixth street.

Philip W. Moen has resigned as Second Vice-President of the American Steel & Wire Co. In 1869 the Washburn & Moen Mfg. Company was incorporated. P. L. Moen was President and Treasurer. His only son, P. W. Moen, entered the business after several years of study of the iron and steel manufacture in Sweden, which followed his graduation from Yale University. He was made General Superintendent and Assistant Treasurer and held these positions until P. L. Moen's death in 1891, when he became General Manager and Treasurer, which offices he held until the Washburn & Moen Mfg. Company was absorbed by the American Steel & Wire Company in 1898. Mr. Moen was made a Director and Third Vice-President of the consolidation, and afterward was promoted to Second Vice-President. He was manager of the Eastern Division of the company's business, which included the Washburn & Moen department. His address for the present will be Shrewsbury, Mass.

Iron and Steel.

The new plant of the American Brake Shoe & Foundry Co. at Chattanooga, Tenn., has been finished and the first iron made.

C. S. Bollen, Consulting Master Mechanic at the Rand Drill Works at Ossining, N. Y., was killed by a locomotive on the New York Central a few days ago. He was 70 years old.

The Long Island Railroad has let contracts to the Owego Bridge Co. for three bridges at Jamaica, which will require about 250 tons of steel. These will be the only bridges built during 1903.

The Plainfield Foundry Company, Plainfield, N. J., has been incorporated with a capital stock of $20,000. The company is to deal in iron, steel and brass and such metals. Incorporators, George B. Naylor, C. E. Gulick and John R. Naylor.

The Cuyahoga Wire & Steel Co. is reported sold to F. A. Umstead, of Ellwood City, Ind., who a year ago made arrangements to buy the plant and the plant of the Hartman Mfg. Co. at Oil City, Pa. The negotiations were not carried out then.

Geo. W. Prescott, one of the founders of the Union Iron Works, San Francisco, is dead in that city. He went to San Francisco from Maine in 1850, and in 1875 formed the shipbuilding firm of Prescott, Scott & Co., which later became the Union Iron Works.

By Feb. 1 a plant to make tool steel will be put in operation by the Norwalk Iron & Steel Co., at Norwalk, Ohio. When finished the company will have two 15-ton open-hearth furnaces and a number of crucible furnaces. The annual capacity will be about 25,000 tons. The company is composed of J. E Carnehan, of Canton, Ohio, and a number of Pittsburgh people. E. E. Erickson, of Pittsburgh, is Engineer and General Manager.

The Iron Age says that largely through the blowing in of blast furnaces in the territory affected by the anthracite coal strike, the capacity for the production of pig iron has been increased. Unfortunately, however, the difficulties of securing coke have very seriously affected the central west, and the actual output is not up to quantity in normal times. This is very well reflected in the figures for the production during November, in connection with which it must be taken into account that the month had only 30 days. A very large number of producers report that they were stopped for longer or shorter periods, waiting for coke. The production for

November was 1,464,423 gross tons. That of October was 1,513,978 gross tons. The total weekly capacity of furnaces in blast on Dec. 1 was 343,581 gross tons, an increase of about 19,000 tons over the same date a year ago.

The Boston South Terminal Yard.

A man who knows writes of the yard at the Boston South terminal station: "After upwards of four years use it has not been found necessary to alter in any particular the track arrangement as laid down at this station. All trains arriving at and departing from this station during that period have been enabled to pass into or out from the station, through the throat tracks, immediately upon arrival, and with the exception of a few misunderstandings and misinterpretations of signals at the opening of the station (previous to February, 1900) there have been no derailments or accidents of any kind to detract from its perfect working. This result has been particularly agreeable to me, as I have always considered the throat arrangement of tracks, together with signal system, as vital points in the successful operation of any large station."

Osmium for Electric Lighting.

Baron von Welsbach, whose name has become a household word through his incandescent gas-burners, has invaded the field of electric-lighting by introducing the metal osmium as the incandescent metal. Osmium is the heaviest and one of the hardest of metals—harder than glass—and almost always occurs alloyed with iridium, having a melting point of about 4,000 deg. Fahr. Its advantage in electric lights is the extraordinary amount of light it gives in proportion to electrical expenditure, and its durability. This is believed to make it especially advantageous for the lighting of cars with accumulator batteries. Its consumption of electricity is little greater for the thousandth hour than for the one hundredth; while certain lamps require 5.2 watt in the thousandth hour, against 2.5 in the first.

Car Heating—Infringement of Patents.

The following letter from the Consolidated Car Heating Co. explains itself: "In reply to the notice which the Safety Car Heating & Lighting Company has seen fit to send out to railroad officials, this company desires to make the following statement: The heating apparatus put on the market by this company is not in any way subject to the patents of R. M. Dixon and W. C. Baker, or to any other patent belonging to the Safety Car Heating & Lighting Company. The apparatus sold by us is based upon the patents of James F. McElroy, Consulting Engineer of this company, which patents are prior to the patents of both Dixon and Baker. The fact that the Safety Car Heating & Lighting Company has seen fit to send its notice broadcast to our customers and has never informed this company that it considered its patents had been infringed, indicates a lack of good faith, and that the notice was sent out solely for the purpose of injuring our business in the sale of our Consolidated Hot Water Drum System, which is rapidly displacing the system of the Safety Car Heating & Lighting Company. We are clearly of the opinion that the publication of this notice by the Safety Company was for business purposes only and not through any fear that this company was infringing its patents. The Consolidated Car-Heating Company has always been very careful not to infringe upon any rights, patented or otherwise, belonging to any other company. We will say further that the Safety Car Heating & Lighting Company could not apply its so-called jacket system to the heating of hot water circuits on cars were it not operating under a license from the Consolidated Car-Heating Company given under the McElroy patents. We have always and shall continue to give guaranteed protection to all of our customers from patent litigation arising from any apparatus purchased of us, and that guarantee extends to all material."

Boston Harbor Improvements.

The War Department has rejected the bids opened on Oct. 30 for dredging a new 35-ft. channel in Boston Harbor. It is said the prices bid on the work were excessive and that new bids are to be asked pretty soon. The bidders were: Carkin, Stickney & Cram, Detroit, Mich.; G. H. Breymann & Bros., Toledo, Ohio; New England Dredging Company, and Eastern Dredging Company, Boston; Bay State Dredging Company, Boston; Morris & Cummings Dredging Company, New York.

The Colorado Fuel & Iron Election.

The annual meeting of the Colorado Fuel & Iron Co., which had been postponed several times, was held on Dec. 10, and the following directors were elected in accordance with an agreement reached between the three contesting factions:

James H. Hyde, H. E. Huntington, E. H. Harriman, J. A. Kebler, J. M. Herbert, A. C. Cass, George J. Gould, J. L. Jerome, Edwin Hawley, John H. McClement, Frank Trumbull, Charles Henry Butler, J. C. Osgood.

The Executive Committee consists of: J. C. Osgood, chairman; A. C. Cass, J. A. Kebler, George J. Gould, J. H. McClement. The officers are: Chairman of the Board, J. C. Osgood; President, J. A. Kebler; First Vice-President, A. C. Cass; Second Vice-President and Controller (in charge of all the finances of the company), J. H. McClement; Third Vice-President, J. L. Jerome. The President announced the appointment of the following officers: General Counsel, D. C. Beaman; General Manager Iron Department, C. S. Robinson; General Manager Fuel Department, John T. Kebler; General Attorney Operating Department, Fred Herrington; General Attorney Land Department, Cass F. Herrington; Assistant Secretary and Assistant Treasurer (residing in New York), C. E. Phelps; Assistant Secretary (residing in Denver), S. I. Heyn; Assistant Treasurer (residing in Denver), A. D. Moss; General Sales Agent, J. F. Welborn; Assistant to the President, R. M. Waite.

Canadian Rails.

On Wednesday of last week Mr. Clergue, of the Algoma Steel Co., announced that the rail mill of the company at Sault Ste. Marie had been closed because all orders had been filled. The Ontario Government is about to order rails for the Temiskaming Railroad, and the Algoma Steel Co. expects to get this contract and start up again. The Canadian Northern recently placed an order for 40,000 tons of rails in Germany, and Mr. Clergue is reported to have said: "There being no duty on rails coming into Canada, the present slaughter price of German rails has enabled the Canadian roads to supply their requirements at prices less than cost at the Soo mills, owing to great difference in labor conditions. Canada is now sending abroad over $5,000,000 annually for rails, of which amount more than $4,000,000 would be expended in Canadian wages and materials, if these orders were given to the Soo mills." The Consolidated Lake Superior Co. is arranging a loan of $1,000,000 through a number of Philadelphia trust companies and banking institutions with the aid of Speyer & Co., and the Morton Trust Company, of New York, and the Mercantile Trust Company, of Baltimore. R. S. Lewis, who succeeded E. V. Douglas as President on Oct. 25, has resigned. No successor is announced, but Theodore C. Search, Vice-President, is now acting President.

An Emergency Telephone for Railroad Service.

Mr. Charles E. Buell, of Camden, N. J., has been allowed a patent on an arrangement for a telephone and call-bell apparatus to be attached to a railroad telegraph line for use in emergencies. The telephones are to be placed in the telegraph offices or the homes of the station agents—or both—along the line, and so arranged as to cause no interference with the ordinary telegraph working. An apparatus for receiving calls is placed at a principal station, and the country station agent desiring to make an emergency communication as, for example, in the night, calls up this central station by pressing a button, and the operator there puts him into communication with the place with which he desires to speak. Thus the line cannot be used for unauthorized telephone communication, as all operations are supervised by the man at the central station. On long lines condensers are provided, where necessary, to prevent disturbance of the Morse instruments. At the central office the call bell is actuated by a local circuit that is closed by a high resistance relay which acts only when an outlying station (which desires communication by telephone) puts on a ground connection, thus increasing the power of the current. The central station calls outlying stations by a magneto generator.

Lackawanna's Car Shops at Scranton.

Plans have been finished for the new car shops of the Lackawanna which will be built in Keyser Valley on the outskirts of the city of Scranton, Pa. There will be about 15 buildings, and the cost will be $500,000. Grading has already been begun, and the contract for the steel work has been let. The buildings will be of brick and steel with concrete foundations, and steel roofs. The power house, 50x150 ft., will be built first. The next building to it will be a lumber shed, 50 x 175 ft., for all kinds of finished lumber. Then comes the woodworking mill, 90x400 ft. Between this mill and the blacksmith shop will be erected a lavatory, about 25x50 ft. The blacksmith shop will be 80x300 ft., with a machine shop 80x180 ft. at right angles, and connected at the end. Just outside the blacksmith shop will be an iron house, 25x50 ft., and directly behind will be built a coal house the same size. Next to that there will be a storehouse, 44x105 ft., two stories high and basement with platform all around it. The second story will be used for the Master Car Builders. In front of the storehouse will be the light repair yard, with tracks for holding 102 cars. This repair yard will have a series of material sheds. In front of the mill and machine shop there are to be two freight shops, 150x400 ft. each, to hold forty-eight cars apiece, and a large lavatory between the two buildings. The freight shops will each be equipped with one fifteen-ton electric crane. In front of the two shops will be a freight paint shop, 60x400 ft., to hold thirty cars. The light for the whole plant will be electric. The machinery from the present car building plant will be used in the new plant, and other new and modern machinery will be added.

The New York & New Jersey Railroad.

On Tuesday, the 16th, the Aldermen of the City of New York granted a franchise to the New York & New Jersey Railroad Company which carries with it the right to build the New York end of the old Hudson River tunnel and to build the New York approach.

The Pennsylvania in New York.

On Tuesday, the 16th, the Aldermen of the City of New York approved the franchise granting the Pennsylvania Railroad Company the right to carry its tunnel lines across Manhattan Island and to build its station thereon.

A Baker Patent Upheld.

A case of some interest was lately decided by Judge Kohlsaat, sitting in the United States Circuit Court for the Northern District of Illinois. This suit was for the infringement of patent No. 472,689, issued to William C. Baker, April 12, 1892, for what is known as the new style combination cock. The defendant in this suit was the Crane Company of Chicago. An injunction has been issued restraining the Crane Company from further infringement and an accounting ordered.

St. Louis Terminal Improvements.

Preliminary to the extensive improvements to be made by the Terminal Railroad Association of St. Louis for the World's Fair, it has let a contract to James Stewart & Co., of St. Louis, for excavating at the St. Louis Union Station for a baggage and express subway 100 ft. wide, extending from one side of the train shed to the other, a distance of 600 ft. The contract for the steel work for this work has been let to the American Bridge Company. James Stewart & Co. also have a contract for the removal of all the express company buildings from the east side of the tracks leading to the station to the west side of the same. The power house will be moved to one side, and this work will be done by the George A. Fuller Company of Chicago.

THE SCRAP HEAP.

Notes.

The Florida East Coast Railway has reduced its passenger fares to a uniform rate of 3 cents a mile.

The Presidents of the railroads in the Trunk Line Association have reaffirmed for 1903 the agreement made one year ago to exchange no passes.

The Louisville & Nashville has established demurrage regulations for freight cars at all of its stations in Tennessee; all will be under the charge of the Nashville Car Service Association.

A roundhouse of the Pennsylvania Railroad at West Philadelphia was crushed by the weight of snow on its roof on December 15, and 22 men were injured. Seventeen locomotives were damaged.

Kansas City papers say that the Atchison, Topeka & Santa Fe is to establish a pension department for aged employees, the fund to be partly supported by contributions from the employees themselves.

The Superintendent of Terminals of the Pennsylvania (East and West) at Pittsburgh, now has an independent telephone exchange to facilitate communication with the 25 principal freight yards in and around that city.

The Pennsylvania Railroad now runs an exclusive train each way over the whole length of the Pittsburgh Division for local business of the Adams Express Company; and it is said that a similar service will be established throughout the main line, Pittsburgh to Jersey City.

The Florida Railroad Commission has summoned the Georgia Southern & Florida to show cause why it should not be fined for increasing rates without authority: though, according to press despatches, the increase (of 20 per cent.) which was made Nov. 1 has been rescinded.

A press despatch from northwestern Nebraska says that the Fremont, Elkhorn & Missouri Valley road is employing (for the first time) Sioux Indians as section men and coal shovelers. These men applied for work in consequence of a diminution in their supply of food and clothing from the government.

The Southern Pacific has issued a circular advising employees that an arrangement has been made with the Continental Casualty Co., of Chicago, by which employees may insure themselves against accident at reduced cost. For policies issued by that company premiums may be paid through the railroad paymaster.

The Western Union Telegraph Co. has put up a large number of new wires along the line of the Buffalo, Rochester & Pittsburgh and the Beech Creek Railroads. It is said that these wires are to carry the business between New York and Pittsburgh, which has heretofore been sent by the Pennsylvania Railroad lines.

On the Lehigh Valley certain freight trainmen have been discovered carrying, on drovers' passes, passengers not entitled to such transportation. It is said that there was collusion between the train crews and the billing clerks at Chicago, who issued the transportation. Some of the stock shippers used their tickets part way themselves and then sold them to other persons for the remainder of the journey.

The Canadian Pacific pension department, which will soon go into operation, will be managed by a committee composed of the President, Vice-Presidents and the Chief Solicitor. The regulations are similar to those of the Pennsylvania, except that a retired employee engaging in other business can do so only with the consent of the committee; otherwise he will forfeit his pension allowance. The age limit is 65 years.

The Camden (N. J.) *Courier* says that next summer the express trains of the West Jersey & Sea Shore will be run between that city and Cape May, 81 miles, in 80 minutes. About half of the line between these two cities now has tracks laid with 100-lb. rails, and the other half is to be renewed. Extensive improvements are going on at Cape May, including the filling in of 1,000 acres of submerged lands to make them available for building.

A number of clerks in the freight office of the Michigan Central at Niagara Falls, N. Y., left their work in a body last week because, according to the press despatches, they were forbidden to belong to a clerks' union; and on Dec. 11, Superintendent John B. Morford, whose office is in Canada, was indicted by the Grand Jury of Niagara County on a charge of violating the section of the Penal Code forbidding an employer to coerce an employee not to join a labor organization.

Press despatches from the west say that President Burt, of the Union Pacific, is proposing to compromise with the striking shopmen, the long continued strike having severely crippled the motive power of the company. To keep trains moving, in spite of the strike, the company borrowed some engines from the Southern Pacific, but now it is said that the shop men in all the shops of both these companies, as well as those on the Oregon lines, threaten to strike at once unless the borrowed

engines are returned. The reporters say that Chairman Harriman will not countenance a compromise.

It is announced that the Southern Railway has increased the pay of a majority of its enginemen, firemen, conductors and brakemen. One statement says that the average rate of increase is 5 per cent., and another says 10 per cent., but the latter apparently includes only one or two classes of the men and includes an estimated increased income for overtime. The firemen of the Boston & Albany have received an increase of pay said to average 5 per cent. A press despatch from Baltimore says that the officers of the Baltimore & Ohio are preparing a schedule of increased wages, but it is not to be a "horizontal" advance.

The investigation into the advance in the freight rates on grain and grain products, dressed meats and provisions from the Mississippi River, Chicago, etc., to New York and other eastern points, begun by the Interstate Commerce Commission at Washington on Monday, was closed the same day, and written statements are to be filed by the railroad by Jan. 10. The chief witness was Traffic Manager George J. Grammer, of the Lake Shore & Michigan Southern. Traffic Manager B. B. Mitchell, of the Michigan Central, also testified. Mr. Grammer stated that railroad expenditures were increasing much more rapidly than earnings; that even at the increased tariffs grain was not being hauled at a profit. Coal prices would not get back to the old figures for years. Another hearing will be held probably in Washington at the earliest practicable date. Traffic and freight managers of the Michigan Central, Lake Shore, Erie, Pennsylvania, Baltimore & Ohio, New York Central, Lackawanna, Lehigh Valley, Chesapeake & Ohio and Southern roads were present.

The agent of the Canadian Pacific at Sintaluta, Assiniboia, has been fined $50 and costs (with the option of imprisonment for one month) for violation of the law requiring freight cars to be distributed impartially to grain shippers applying for them. The complaint, which is made by Mr. Armis, a farmer, charged that the agent refused to supply a car to Armis while he gave cars to others whose orders in the order book were subsequent to Armis' order; that he refused, when there were cars available, to permit the farmer to load a car on the siding, there being a loading platform here, and refused to hold the car for the farmer until it could be placed at the platform; that he treated the loading platform as being equivalent to an elevator, so far as concerns orders for cars; that he refused to allow the farmer who had grain in a special bin in an elevator to load a car at such elevator, and refused likewise to allow him, when he had graded wheat stored in an elevator, to load cars at such elevator, claiming that only the elevator manager had a right to order cars for loading at the elevator; that the accused had failed to distribute cars in the order of application, and that when fresh batches of cars arrived accused day by day commenced distributing them singly from the beginning of the list of orders instead of to applicants who had not received any cars.

Traffic Notes.

The severity of the anthracite coal famine has led to numerous charges that the managers of the large companies are not fair and impartial in distributing cars and shipping coal; but the presidents of all the coal carrying roads resent the imputation; and in particular deny that they are holding back coal. A careful canvass of all the companies develops the situation as being entirely a transportation problem. Every possible car and locomotive is being pressed into the coal service and office forces are being transferred, where necessary, to facilitate the train movement.

The Siberian Railroad.

Under date of Oct. 9, 1902, the United States Commercial Agent at ~~Vladivostock~~ writes:

When one reflects that the construction of this road has cost thus far 780,000,000 rubles ($401,700,000), it is not reasonable to expect that its exploitation would be immediately profitable. Allowing only 4½ per cent. interest on the capital invested and for the sinking fund, 34,750,000 rubles ($17,896,250) would be needed. In 1899, the expenses averaged 5,000 rubles ($2,575) a verst (0.663 mile). The Chinese Eastern Railroad will cost more, and as faster train service becomes necessary the average cost per verst will be 6,000 rubles ($3,090). Therefore, for the entire length of the road—7,762 versts (5,146 miles)—the cost must approach 47,000,000 rubles $24,205,000) per year. To cover this expense of 80,000,000 rubles ($41,200,000) annually, the traffic should reach 400,000 metric tons of freight each year. No such amount of traffic may be looked for at once. To cover the expense of exploitation only, 166,000 metric tons would be required. In 1898, the traffic amounted to 37,000 metric tons; in 1899, to 40,000 metric tons; in 1900, to 45,000 metric tons. The increase would have been greater but for the unfavorable conditions prevailing in Siberia—Chinese riots, bad harvests for two consecutive years, etc. In any event, the increase of traffic must be greatly augmented to pay expenses.

Forbidden Newspapers.

The Belgian railroads are so careful of the morals of their passengers that they forbid the sale of certain newspapers in their stations. A French illustrated newspaper lately put on their index expurgatorius was the 47th to be officially condemned.

The Newspaper Critic in Russia.

The Russian newspapers, like some others, do not hesitate to find fault with the railroads. One of them has been criticising the "improvements" in train service shown by the new winter time-tables. It says that the speed of most of the express trains has been reduced. It is perhaps not unreasonable that in Russia, where snow falls sometimes, speed should be less in winter than in summer; but the impertinent Russian journalist questions the propriety of calling "express" trains those which for the most part run not more than 25 miles per hour, while the fastest of all, the cannon-ball express of all the Russias, runs between Moscow and St. Petersburg at the rate of 32 miles an hour. On one long line he finds that the express train carries passengers in 23 hours and 32 minutes, charging 20 per cent. more than the ordinary passenger train which goes over the same line in 21 hours and 36 minutes. On another line where three years ago you made the journey in an ordinary train in 3 hours 45 minutes for $1.06; now you go in an express train in 4 hours for $2.80.

Through Service to Manchuria.

St. Petersburg papers announce that the government commission appointed in August to arrange for through connections from the western border of Russia across European Russia and Siberia to the Chinese border has completed its labors. The arrangement extends only to the western terminus of the Chinese Eastern Railroad, which is here for the first time called "Manchuria Station." No time-table over the latter railroad is announced, and apparently connections are not assured; the Russian papers say that it will be about a year before regular trains are running over it. The arrangements now made provide, as heretofore, that the through Siberian trains shall start from Moscow; and Moscow may be reached from the German border either by way of St. Petersburg; that is, by traveling first northeast and then southeast, or more directly eastward from the border through Warsaw. There is but a few cents difference in the fares by the two routes. From the border at Wirballen through to Manchuria, 5,120 miles, first-class fare is 154 rubles = $79.31, or 1.53 cents per mile. The second-class fare is only $5.15 less. The time from Wirballen to Manchuria station is given as 12 to 13 days.

Report on Gloversville Disaster.

The report of Inspector Barnes of the State Railroad Commission on the Mountain Lake Railroad disaster (Gloversville, July 5, *Railroad Gazette*, Aug. 1, p. 610; 13 persons killed) has been made public. He finds that President Keith had no practical knowledge of the details of operation, that Master Mechanic Park Haggart was not properly qualified for the various duties of his position, and that Conductor Yost, of the runaway car, was incompetent, lacking in courage and presence of mind; and all motormen were inexperienced. The direct cause of the accident, according to the report, was that William Dodge, the dead motorman, did not use proper precautions in operating the car down the heavy grade; the primary cause was the way in which the road was operated.

The inspector states that Electrician Haggart did not have the proper qualifications to occupy the position he held, and scores him severely for the lax manner in which motormen were employed, and for the running of cars with men who had never had any experience as well as failing to preserve proper discipline.

The evidence, according to the report, shows that Yost was incompetent to fill the position of conductor. If the management of the road was such as the safety of operation requires, he would have been immediately dismissed from its employ. Instead he is promoted to the position of chief inspector at the car barn. The officers are severely scored for their lax way of managing the line and a number of recommendations are made, including the establishment of a block signal system, derailing switches, inspectors at the top of the mountain, safety appliances, etc.—*Albany Journal.*

Special Cars for Medical Aid.

At a recent meeting of the German Society of Mechanical Engineers was described the new special medical cars recently installed on the Prussian State Railroads. As reported by *Glaser's Annalen* it consists of a train of two cars, one an ordinary wrecking car and another a passenger car. The car has double doors at the ends and platforms with removable folding railings.

The interior of the car is divided into two parts connected by a door. The smaller space serves as the physician's room, the larger as the sick room. The physician's room has been well lighted by side windows and an overhead lantern with about 32 sq. ft. of wire glass. It contains an operating table, an instrument and bandage closet, a wash stand and rapid water heater with water tank. Small folding tables are attached under each side window. Two upholstered leather folding chairs, two foot stools, one ice pail, etc., make up the rest of the furniture. The floor slopes towards a drainage opening at the center. A closet is provided in one corner.

The sick room contains eight berths, two in a row, one on top of the other. Two special chairs are provided for those only slightly injured. The ceiling and walls of the car are painted with a white enamel. The floor of the whole car is covered with linoleum. The operating table is made of wrought iron and is covered with leather cushions. The car has an independent heating system.

The Consumption of Lubricating Materials on the Prussian State Railroads.

The consumption of lubricating materials on locomotives of the Prussian State Railroads is regulated by a system of prizes which are distributed to the employees directly concerned with the attendance of locomotives. To obtain definite information on which the allowed amount of lubricants shall be based careful observations on different kinds of locomotives have been made. As reported in *Glaser's Annalen* they are essentially as follows:

The lubrication of the locomotives was prescribed as follows: All the oil cups were only filled about two-thirds full; those parts which have only lubricating holes were oiled by an oil brush and not by the oil can. After the trip all the waste was taken out, the employees on the locomotives had strict orders not to fill the lubricating boxes during the trip. Attention was called to the fact that if an axle or a piston rod bearing, etc., is running hot, this will not be prevented for any length of time by an excessive filling of the boxes.

A considerable saving in lubricant was the result of the above mentioned rules and inspection. In the fiscal year 1901-1902, in one inspection district, 106,000 lbs. has been saved as compared to the previous year. A similar reduction in the remaining 81 inspection districts in which the Prussian State Railroads are divided would give a saving of 9,000,000 lbs. of lubricating oil.

The Illinois Central Increases Its Suburban Service.

Beginning Sunday, December 7, the Illinois Central put more trains into its Chicago suburban service better to care for the heavy traffic during the morning and evening rush hours. In the evening express trains are run at four-minute intervals between 5:35 and 6:15, the express trains not stopping north of 53rd street. Local trains between these hours are run at five-minute intervals. During the morning rush, both express and local trains run at five-minute intervals, the rush being extended over a longer period and not being so dense at any given time as in the evening. Also two night express trains for theatre-goers have been put on, leaving the city at 11:05 and 11:20 p.m.

The Pennsylvania and the "Blockade."

The following report comes to us from a New York banker:

"I have never seen in the papers hereabouts any recognition of the great work of the Pennsylvania railroad men a few Sundays ago in breaking the Pittsburgh freight blockade. It will be recalled that the Pennsylvania railroad a month ago became so blocked with freight that it later issued orders refusing coal shipments and grain freights for from three to five days. Then all the available forces of the road were summoned upon Sunday to break the greatest freight blockade that had ever arisen in the history of railroading. Every man available from the president down to the yardmen set at work all day Sunday at that Pittsburgh blockade. Men worked as railroad men had never worked befofe in the world. They worked until they lay down on the ground exhausted. People in the neighborhood opened their houses and furnished hot coffee and couches for the exhausted men. Every man in Pittsburgh felt a personal interest in the Pennsylvania railroad, and in its efforts to break that blockade. The result is without a parallel in the railroad world. Sixty-six thousand loaded freight cars were moved in and out of Pittsburgh that Sunday and sent on their way. This crush of loaded freight cars had been accumulating nearly a month, and was due to the unprecedented and unexpected volume of traffic that for the last four months has overmatched the railroad facilities of the United States. The passenger travel has been so unprecedented this fall as to throw the movement of the greatest freight tonnage the world has ever seen temporarily out of gear."—*Wall St. Journal.*

The banker's imagination got a little warm. Railroad men have done some good jobs of sustained work before, as, for example, at the Johnstown flood time; but the picture which he draws is essentially correct.

Erie.

Quite a number of substantial houses are inclined to take a bullish attitude on Erie in view of the relatively better showing which the road made during the continuance of the coal strike than was made by other roads largely concerned in the anthracite trade. Erie has now much less loss to make up than have the other companies, in proportion to the tonnage of anthracite handled, and with the high price now being obtained for the coal and the certainty that the volume of business will continue up to the company's capacity for a considerable time to come, there is a strong belief in some quarters that results for the present fiscal year may exceed those of the year ended June 30, 1902. It is stated that it is only a question of time until, by the expenditure of additional capital, Erie will take its place among the foremost of the trunk lines, and that earnings may be so expanded that after providing the additional charges called for by the new capital, which will probably be provided by a sale of bonds, there will still be left such a surplus for the stocks as will make even the common look attractive.—*Wall Street Journal.*

United Action Against Scalpers.

The day of the railroad ticket forger and dealer in fraudulent transportation is almost over. Action taken yesterday by the executive committee of the Western Passenger Association makes it certain that, within one month, the National Protective Bureau, embracing practically all the railroads in the country, will be in operation, with headquarters in Chicago. The chairmen of the various passenger associations will constitute the executive committee of the bureau, and the work of detecting and prosecuting anybody who alters or forges a railroad ticket or pass, or who sells railroad transportation of any kind, which has been improperly manipulated, will be done by the Pinkerton National Detective Agency. It will keep watch on crooked ticket scalpers and their confederates, just as it does on criminals, for the American Bankers' Protective Association.—*Chicago Inter-Ocean.*

It is reported that many of the ticket brokers in Chicago have closed their offices and are departing for other fields of endeavor. The aggressive attitude of the railroad companies, aided by the restrictive laws relating to ticket scalping, has made the business in Chicago unprofitable on legitimate lines and precarious when conducted on methods that have prevailed hitherto. Several of the brokers have gone to St. Louis, where the existing laws are said to be more liberal for their purposes.

LOCOMOTIVE BUILDING.

The Baldwin Works have miscellaneous orders for building five locomotives.

The Baltimore & Ohio is having four electric engines built at the General Electric Works.

The New York, Chicago & St. Louis is having three locomotives built at the Baldwin Works.

The Mercer Valley is having one locomotive built at the Cooke Works of the American Locomotive Co.

The New York, Ontario & Western is having two locomotives built at the Cooke Works of the American Locomotive Co.

The Richmond, Fredericksburg & Potomac is having 10 locomotives built at the Richmond Works of the American Locomotive Co.

The Canadian Pacific is reported to have let contracts for building a large number of locomotives to Neilson, Reid & Co., of Glasgow, Scotland.

F. M. Hicks, of the Hicks Locomotive & Car Works, has received orders to rebuild one locomotive for the Ahnapee & Western, and one for the Illinois Valley Belt Line.

CAR BUILDING.

The American Car & Foundry Co. has miscellaneous orders for 98 cars.

The Wabash has ordered 47 coaches from the American Car & Foundry Co.

The West Side Belt (Pittsburgh) is having 500 freights built by the Pressed Steel Car Co.

The Chicago & Eastern Illinois has ordered 32 coaches from the American Car & Foundry Co.

The Southern Pacific has ordered 1,000 flat cars of 80,000 lbs. capacity from the Pressed Steel Car Co.

The New Orleans & Northeastern (Queen & Crescent) has ordered 10 coaches from the American Car & Foundry Co.

The Pittsburgh & Lake Erie is having five freights built at the Indianapolis Works of the American Car & Foundry Co.

The Great Northern Construction Co. is having 20

freights built at the Detroit Works of the American Car & Foundry Co.

The Chicago Terminal Transfer is building six cabooses at its own shops, and is reported in the market for additional equipment.

The Intercolonial of Canada has recently contracted for 300 box cars of 80,000 lbs. capacity, and will not require any more box cars at present.

The New York, New Haven & Hartford has ordered 2,000 box cars, steel underframe, from the Standard Steel Car Co., and 500 pressed steel cars from the Pressed Steel Car Co.

The Ingoldsby Automatic Car Co. has the following orders: From the St. Louis & San Francisco, 10 patent wooden dump cars of 80,000 lbs. capacity; from the Cleveland Furnace Co., 25 patent dump cars of 100,000 lbs. capacity; from the Colorado Fuel & Iron Co., 10 patent dump cars of 50,000 lbs. capacity; from the Guggenheim Exploration Co., Santa Barbara, Chihuahua, Mexico, two patent steel dump cars of 22,000 lbs. capacity; from the Texas Short Line, three patent wooden dump cars of 100,000 lbs. capacity. All these cars are to be built by the American Car & Foundry Co. at Detroit, Mich., deliveries ranging from January to March, 1903.

BRIDGE BUILDING.

Atlantic City, N. J.—The County Freeholders will soon want bids for two steel draw bridges. Address H. G. Mullock, Atlantic City.

Augusta, Ga.—The House of Representatives on Dec. 2 passed a bill which has also been introduced in the U. S. Senate authorizing a bridge across the Savannah River at Sand Bar Ferry, below Augusta, Ga.

Baltimore, Md.—The Western Maryland Tidewater R. R. proposes to build a bridge over Middle Branch, Patapsco River.

Bath, N. B.—Charles E. Gallagher, of Bath, one of the promoters, will apply at the next session of the local Legislature for an act incorporating The Bath Bridge Company, to build a bridge across the St. John River at Bath.

Belen, N. Mex.—The Atchison, Topeka & Santa Fe cut-off, the Eastern R. R. of New Mexico, will bridge the Rio Grande at Belen.

Camden, N. J.—Bids are wanted by the Camden Board of Freeholders for building the proposed bridge over Cooper's Creek at Baird avenue. A private concern has offered to build the approaches to the proposed bridge.

Chattanooga, Tenn.—An officer of the Queen & Crescent Route denies the report that a new bridge will be built over the Tennessee River above Chattanooga, as persistently reported.

Cleveland, Ohio.—The Lake Shore & Michigan Southern Railroad has expressed a willingness to co-operate with the city in the effort to do away with the grade crossings along its line. This railroad is the first to make any definite announcement of this nature. E. A. Handy, Chief Engineer of the road, has prepared plans for the abolition of the Detroit street crossing, which is the worst on his line.

Colfax, Wash.—Bids with plans are wanted Jan. 6 for a plate girder bridge 200 ft. wide and 46 ft. long over South Palouse River in Colfax. Specifications may be seen at this office. Also for a bridge over the Pine Creek. Address H. H. Wheeler, County Auditor.

Colorado Springs, Colo.—The city officers and the Santa Fe Ry. are considering building a bridge at the Costilla street crossing.

Council Bluffs, Iowa.—The County Auditor will receive bids from Iowa firms only for building bridges in the county for the year beginning April 1, 1903.

Danville, Ill.—It is said nothing has been decided in regard to the bridge to be built between Danville and Vermillion. The funds will not be appropriated until next May.

Easton, Pa.—The incoming Board of County Commissioners has enjoined the retiring Board from awarding the contract for the bridge over Brodhead Creek at Stroudsburg.

Fort Collins, Colo.—Bids are wanted Dec. 22, by John E. Ramer, County Clerk, for a 120-ft. steel bridge.

Franklin, Pa.—The County Commissioners have let the contract for the new bridge over the Allegheny River at Scrubgrass to the Penn Bridge Company of Beaver Falls. Seventeen companies filed bids.

Fredericton, N. B.—The Provincial Department of Public Works is having plans prepared for the steel superstructure of the Opomocto bridge, and for Acker Creek, and Bull Creek bridges in Carleton County; and McCleary bridge in same county.

Fremont, Neb.—Bids are wanted until Dec. 30 at the County Clerk's office for doing all the bridge work in Dodge County next year.

Girard, Kan.—Bids are wanted Dec. 27 by John Viets, County Auditor, for a 360-ft. steel bridge, according to plans on file in his office.

Grand Forks, N. Dak.—The Grand Forks Council has accepted the proposition made by the Polk County (Minnesota) Commissioners for a bridge over Red Lake River between Grand Forks, N. Dak., and East Grand Forks, Minn.

Hamilton, Ont.—The Hamilton & Caledonia Electric Ry. will want bids early in February for the following bridges: Under the Grand Trunk at Caledonia; under the Michigan Central Ry., at Deans; widening and strengthening highway bridge over Grand River at Cayuga; bridge over G. T. R. at Cayuga. J. W. Tyrrell, Hamilton, is engineer in charge.

E. C. Barrow, City Engineer, has prepared plans for a steel bridge at Brant street.

Harrisburg, Pa.—Herman Laub, of Pittsburgh, has been selected by the Board of Public Buildings & Grounds to make plans and specifications for the new State bridge over the Chenango River at Pulaski, Lawrence County.

Hondo, Medina Co., Texas.—The Commissioners' Court has selected the plan of S. A. Oliver, of Houston, for the bridge across the Medina River at Castroville, consisting of one 252 ft. steel span and two 100 ft. spans, total 152 ft., on stone abutments. The estimated cost is about $12,500.

Hoquiam, Wash.—It is said bids will soon be wanted for a bridge over Hoquiam River; also for a bridge over Black Creek. Address the County Auditor.

Joliet, Ill.—A joint county bridge is proposed over Kankakee River between Will and Brundy Counties at a cost of $25,000. The Will County officers have already approved the resolution.

Kansas.—The House of Representatives on Dec. 6 passed the bill authorizing a bridge across the Missouri River within five miles north of the Kaw River in Wyandotte County, Kan., and Clay County, Mo., the bridge to be a post route. (June 13, p. 452.)

Kansas City, Mo.—Mr. Mudge, General Manager of the Atchison, Topeka & Santa Fe, says that plans are being considered for the Summit avenue viaduct. The Kansas City Belt Line and the Metropolitan Street Ry. are to divide the expense.

Lake Charles, La.—The Police Jury is about to let a contract for a steel bridge over English Bayou. It will be 124 ft. span and the first steel bridge in the parish.

Lincoln, Neb.—The Sanitary Trustees have decided to straighten Salt Creek by cutting a new channel across North Twelfth street, north of the present bridge, making it necessary either to build a new bridge or move the present bridge.

McLeod, Northwest Ter., Canada.—Hon. A. L. Sifton, Commissioner of Public Works of the Northwest Territories, is arranging to build two bridges, one at McLeod, which will cost $20,000, and the other at Lethbridge, which will cost $40,000. He asked Canadian bridge building companies if the structures can be erected by March 14 next. It is said that this cannot be done and there is probability of the contracts being placed in the United States.

Minnesota.—A bill has been introduced in the U. S. Senate and House of Representatives authorizing a bridge across Rainy River, in Minnesota.

New York, N. Y.—The Bridge Commissioner on Dec. 11 opened bids for the construction of the tower foundation in Manhattan of the Manhattan Bridge. The contract was awarded to John C. Rodgers, who built the Brooklyn foundation for the tower. His bid was $482,756.56, or about $11,000 less than his bid for the Brooklyn foundation. This foundation is the same as the Brooklyn one, which was described in the *Railroad Gazette*, March 1, 1901.

Oacoma, S. Dak.—On Dec. 6 the House of Representatives passed the bill authorizing the Federal Railroad Company to build a combined railroad, wagon and foot bridge across the Missouri River, at or near Oacoma, S. Dak. (June 6, p. 420.)

Olivet, S. Dak.—Bids are wanted Jan. 7 by the County Commissioners for two steel bridges. D. D. Wipf, County Auditor.

Paducah, Ky.—The St. Louis & San Francisco, according to report, will bridge the Ohio near here on an extension.

Pennsylvania.—A bill has been introduced in the House of Representatives authorizing the Counties of Washington and Westmoreland, Pa., to build a bridge across the Monongahela River.

Peoria, Ill.—It is said that bids will be wanted next month for the bridge over Farm Creek.

Philadelphia, Pa.—Local reports state that plans for the Market street bridge for the Philadelphia Rapid Transit to cross the Susquehanna River have been finished and will soon be submitted to the Executive Committee.

Pottstown, Pa.—The Grand Jury has approved of the plans for a bridge over Towamencin Creek at a cost of $2,500, and another bridge at a cost of $3,700 over a tributary of Pennypack Creek.

Rome, N. Y.—Bids are wanted Jan. 1 for building the substructure of the bridge over Mohawk River at East Dominick street. Contract for the steel was let last summer to the Owego Bridge Co.

St. John, N. B.—A committee has been appointed by the City Council to consider the question of building a bridge across the harbor.

Spokane, Wash.—The Washington Water Power Co. will build a double-track steel bridge across the Spokane River at Post street on extensions of its trolley railroad.

Plans are being made by the City Engineer for a combination bridge over Hangman Creek which will cost about $25,000.

Tacoma, Wash.—Reports state that the preliminary plans for the Puyallup draw bridge to be built at South Twenty-first street have been submitted to the County Commissioners.

Tennessee.—A bill has been introduced in the U. S. Senate and House of Representatives authorizing the Knoxville, La Follette & Jellico R. R. Co. to build a bridge across the Clinch River, in Tennessee.

Terre Haute, Ind.—Bids are wanted Dec. 31 for building about 19 bridges, both stone and concrete, and five steel bridges in various townships. James Soule, County Auditor.

Washington, D. C.—The Commissioners of the District of Columbia have again approved a bill before Congress providing for rebuilding the superstructure of the Aqueduct bridge across the Potomac River to allow a single track electric line of the Great Falls & Old Dominion R. R. Co., incorporated in Virginia, to build an electric railroad up the Virginia side of the Potomac to Great Falls, to be carried across it.

Waycross, Ga.—The floods of the Saltilla River destroyed the Atlantic & Birmingham railroad bridge near Waltertown, also a large trestle.

West Springfield, Mass.—The Boston & Albany will build a new bridge over the Connecticut River, possibly in the spring.

Windsor, Ont.—The Sandwich, Windsor & Amherstburg Ry. will probably want bids soon for a bridge over Conard River in Essex County, Ont.

York, Pa.—Part of the $230,000 just borrowed by the County Commissioners will be used in building a bridge over Cordorus Creek at Richland avenue.

Other Structures.

Annapolis, Md.—The Baltimore, Washington & Annapolis intend erecting machine shops and car sheds at Annapolis. Plans have been prepared for a one-story brick building 180 by 60 ft. in dimension; the estimated cost is about $25,000.

Bedford, Ohio.—The Interstate Engineering Co., recently organized in this city with a capital of $300,000, will build a structural steel plant at Bedford. The incorporators are Paul Schneider, of Bedford; J. W. Kaltenbach, C. A. Klump, Martin Mullen and others, of Cleveland. The structural shop of the plant will be 600 x 160 ft.; the foundry 400 x 120 ft. The other buildings will be of smaller dimensions.

Buffalo, N. Y.—The International Steam Pump Company is about to build a large machine shop. It will be near the site of the present plant on the west side of Roberts avenue, 1,630 ft. south of Clinton street. The new plant will be 534 ft. wide and 110 ft. long, and will cost $110,000.

Canal Dover, Ohio.—The corrugating mills, the paint shop, the store room and the building containing four mills of the American Sheet Steel Company's plant, burned to the ground Dec. 13. The loss is $1,000,000, nearly $750,000 being in finished product and the rest in buildings and machinery.

Cleveland, Ohio.—Local reports state that the plan of grouping Cleveland public buildings is beginning to be realized. All the buildings are either in the process of construction or their plans have been drawn and money appropriated for their construction. The buildings are as follows: New Union passenger station, $6,000,000; U. S. Government building, $2,500,000; City Hall building, $250,000; public library building, $500,000.

Dallas, Texas.—The International & Great Northern, it is said, will not build a terminal of its own in Dallas, but will use those of the proposed Terminal Railway recently organized to erect a passenger station in Dallas.

Dayton, Ohio.—The C., H. & D. has applied to the City Council for the passage of an ordinance to vacate certain streets upon which the railroad will build a new freight house.

Eddystone, Pa.—Contracts will be let soon for the new plant of the Sterlingworth Railway Supply Co. About 25 rolled steel cars a day will be the capacity.

Elkhart, Ind.—The shops of the Lake Shore & Michigan Southern in Elkhart will be doubled in size, the work to be begun in the spring.

Indianapolis, Ind.—Work is to begin soon on the new interurban terminal station at Illinois and Market streets. According to the announcements, this station and office building of the Traction & Terminal Company will have 160 ft. front on Illinois street, the full frontage between Illinois street and Capitol avenue on Market street and 250 ft. frontage on Capitol avenue. Fronting on Illinois street will be the office building. It will be at least nine stories high and will have an arcade leading from Illinois street to the waiting rooms for the interurban cars. These cars will enter sheds back of the office building. A waiting room 35 ft. wide and 160 ft. long will be provided. At the north end of the sheds a series of tracks will be put in to retain cars for various emergencies. The contract for the steel has been let. The total cost will be over $1,000,000.

Johnstown, Pa.—The contract for the steel work for the new buildings of the Lorain Steel Company's plant at Johnstown is let to the American Bridge Co.

Lorain, Ohio.—The plans for the improvements to be made by the U. S. Steel Corporation here include eight new blast furnaces and four new finishing mills. The latter will be smaller than any of the present mills.

New Albany, Ind.—The Southern, according to reports, is planning to establish new shops, and possibly, division headquarters at New Albany, where the old "Monon" shops are.

New Castle, Pa.—The capital stock of the New Castle Forge & Bolt Co. has been increased from $75,000 to $300,000. New buildings are to be put up to accommodate the expanding business.

New Orleans, La.—The Illinois Central station at Howard avenue and S. Rampart street will be remodeled.

Philadelphia, Pa.—Contract has been let for a corrugated iron grain elevator at Germantown Junction for the Pennsylvania. It will be 163 ft. high, 126 ft. long and 76 ft. wide, and adjoining it will be a power house 50 x 35 ft. Geo. M. Moulton, of Chicago, is the contractor.

Portland, Ore.—Bids are wanted at the office of the Port of Portland, Ore., Jan. 8, for the whole or any part of an issue of $150,000 of bonds which is to pay for the new dry dock to be built there. Ben Selling is Secretary.

San Antonio, Texas.—Despatches say that as a result of the constant harassment by the City Council of San Antonio, the Southern Pacific has determined to remove its roundhouse, shops and yards to a new town to be built about five miles from that city. As much of the work as possible will be sent to Houston until such time as the new buildings are completed and the shops so arranged that they can do the necessary work.

Soudersville, Ga.—The Augusta Southern will build a station at Soudersville.

Toronto, Ont.—The Canadian Pacific contemplates, at an early date, increasing the size of its car shops at Toronto Junction.

Washington, D. C.—The Committee on Public Buildings & Grounds of the House of Representatives last week favorably reported the bill providing for a site and building for the Department of Justice, the Supreme Court, Law Library, and for a meeting place for international tribunals, to cost $7,000,000, and to be located opposite the Library of Congress; the Committee also reported favorably the bill providing for a new building for the Department of Agriculture, but cut the limit of cost from $2,500,000 to $1,500,000.

The House of Representatives on Dec. 15 passed the bill reported to it last week by the Committee on the District of Columbia and providing for the new Union station on the Massachusetts avenue site, and to cost $4,000,000. This bill was passed by the U. S. Senate last session, but as now passed by the House it carries a number of amendments, among them one providing for a suburban passenger station to be located by the Baltimore & Potomac R. R. at the city end of the new Long Bridge so that Alexandria passengers need not pass through the tunnel to the Union station. The estimated cost of the work to be done by the railroad companies is $11,073,103, and to the United States and the District of Columbia, including damages to property, $3,770,000, or a total cost for the improvement of $14,843,103.

West Springfield, Mass.—The Boston & Albany is planning to build a much larger roundhouse here in the spring. Plans are said to be about finished. Additions are now being made to the shops and a new bridge is proposed over the Connecticut River. This latter work may also be done in the spring.

Wheeling, W. Va.—The Davees Car Wheel Co. will build a plant above Wheeling, in which to make car wheels with chilled steel rims. About $50,000 will be spent upon the works.

The Kirker Engine Co. will make gas engines at Wheeling. Its capital is $50,000. The company is composed of A. T. Young, C. R. Hubbard, W. E. Stone, J. A. Miller, L. F. Stifel and others. L. S. Kirker is the patentee of the engine. The company has bought the plant of the Center Foundry Co., which will be remodeled.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xvi.)

American Society of Civil Engineers.

"The Sanitary Disposal of Municipal Refuse" was the subject on Dec. 17 for informal discussion which was opened by Rudolph Hering.

Brooklyn Engineers' Club.

New officers were elected on Dec. 18 as follows: Andrew J. Provost, Jr., President; Frederick S. Woodward, Vice-President; John Middleton, Treasurer, and Joseph Strachan, Secretary.

Iowa Railway Club.

At the meeting of the Iowa Railway Club on Dec. 16 an interesting paper on "Enforcement of Car Service Rules and the Benefits Derived Therefrom," was read by Mr. P. H. O'Connor, of Perry Iowa. Discussion was held on accident reports by members of the club.

New England Railroad Club.

At the regular meeting of the New England Railroad Club, at the Pierce Hall, Boston, on Dec. 9, a paper on "Electrically Driven Shops" was presented by Mr. Robert L. Warner, Boston Sales Manager of the Westinghouse Electric & Mfg. Co. Mr. Warner's paper was illustrated by a large selection of stereopticon views showing many examples of the application of direct-current and induction motors to the driving of machine-shop tools and other apparatus.

Car Foremen's Association Formed at Pittsburgh.

An organization has been formed in Pittsburgh known as the Pittsburgh Carmen's Association. It was formed at a meeting held on Dec. 10 in the office of the general car foreman of the Baltimore & Ohio, at Glenwood, and men were present from the Pittsburgh, Virginia & Charleston, the Union and the Monongahela Connecting Railroads. The names of the officers are as follows: President, H. C. Buckalew; Vice-President, W. A. Riffle; Treasurer, C. W. Lenhart; Secretary, J. W. Boyles. W. F. Ryan and W. H. Linsenbigler, with the President and Secretary, constitute the executive committee. The association will meet the second and fourth Wednesdays of each month at the general car foreman's office at Glenwood.

Pacific Northwest Society of Engineers.

The Pacific Northwest Society of Engineers held its regular monthly meeting on Saturday evening, Dec. 6, at 8 p.m., in the Chamber of Commerce rooms, Seattle. Mr. C. E. Fowler, President and Chief Engineer, Puget Sound Bridge & Dredging Company, presented a paper on "The Corrosion of Iron and Steel." Mr. Fowler dealt first with iron in its pure state, the different kinds of iron and steel used, the chemical composition of rust, the best methods for cleaning and preserving iron and steel, and the usual length of life of them under different conditions.

The Society has shown a healthy increase at each meeting, and at the January meeting new officers are to be elected for the ensuing year.

1903 M. C. B. and M. M. Conventions.

The 1903 meetings of the Master Car Builders' and American Railway Master Mechanics' Associations will be held at the Grand Hotel, Mackinac Island, Mich., the former beginning June 17 and the latter June 22. The following schedule of prices has been agreed upon: Single room, one person, $3.00 a day; double room, one person, $4.00; double room, with bath, one person, $5.00; extra large double room, with bath, one person, $6.00; double room, two persons, $6.00; double room, with bath, two persons, $8.00; extra large double room, with bath, two persons, $10.00. These rates, of course, include board. Applications for rooms should be made to Henry Weaver, Planters Hotel, St. Louis, Mo., and for space for exhibits to J. Alexander Brown, 24 Park Place, New York, N. Y.

American Institute of Architects.

The 36th annual meeting of this Institute was held at the New Willard Hotel at Washington, D. C., Dec. 11 to 13, and was attended by representatives of the 25 chapters composing it. Among the papers presented and discussed were: "The Relations of the Architect and the Engineer," by Capt. John S. Sewell, U. S. A.; "The Development of Architecture," by J. L. Smithmyer; "The Organization for Municipal Improvement," by Albert Kelsey; "The Modern City," by Owen Fleming; "Improvements in London, England," by E. L. Masqueray; "Water Effects in Landscape as Applied in the St. Louis Exposition," and a topical discussion on "The Development of Municipal Improvement." The competing plans for the new municipal building at Washington were open for inspection. The old officers were re-elected for the ensuing year: President, Charles F. McKim; First Vice-President, Frank Miles Day; Second Vice-President, Alfred Stone; Secretary and Treasurer, Glenn Brown; Members of the Board of Directors, Robert S. Peabody, William B. Mundle, Isaac C. Ditmars. The next meeting of the Institute will be held at Cleveland, Ohio.

Franklin Institute.

The bulletin for the current month is as follows:

Wednesday, Dec. 17, stated meeting of the Institute.—"A New Process of Butter Making," Charles M. Taylor, Jr., Philadelphia; "The Brazing of Iron Castings," Mr. H. Armor Ward, American Brazing Company, Philadelphia.

Thursday, Dec. 18.—"Coal Handling," Mr. F. V. Hetzel; and "Ore Handling," Mr. A. C. Johnston, Link-Belt Engineering Company, Philadelphia.

Thursday, Jan. 2.—"Stability of Nitrocellulose and Nitrocellulose Powder," illustrated, Mr. Albert, P. Sy., Frankford Arsenal. Prof. Eugene C. Foster may present a paper on "The Commercial Production of Oxygen from Liquid Air."

Thursday, Jan. 8.—"Automatic Electric Railway Signaling: Its Purposes; Also Past and Present Installations." Mr. C. C. Rosenberg, Signal Engineer, and Mr. H. S. Balliet, Assistant Signal Engineer, Lehigh Valley Railroad, Bethlehem, Pa.

The following is the programme of Popular Science lectures to be given in Association Hall, 15th and Chestnut streets, Philadelphia, under the joint patronage of the Institute and the Central Branch of the Y. M. C. A.: Jan. 16, Mr. Wm. C. Henderson, Philadelphia, "Some Personal Experiences, Adventures and Observations During the Gold Stampede Into the Unknown Interior of Arctic Alaska in '98"; Jan. 23, Mr. George H. Wirt, State Forester of Pennsylvania, "The Forest Policy of Pennsylvania"; Jan. 30, Prof. Angelo Heilprin, Philadelphia, "Mont Pelée and Its Work of Death"; Feb. 6, Mr. W. N. Jennings, Philadelphia, "'Snap Shots' Up to Date"; Feb. 13, Mr. Martin I. Wilbert, German Hospital, Philadelphia, "Modern Uses for the X Rays"; Feb. 20, Prof. Oliver L. Fassig, United States Weather Bureau, Johns Hopkins University, "Ancient and Modern Methods of Weather Forecasting."

PERSONAL.

—Hon. M. A. Knapp, Chairman of the Interstate Commerce Commission, has been re-appointed for the term of six years from Jan. 1, 1903.

—Mr. E. E. Blackwell, Assistant Engineer in charge of construction of the Texas & New Orleans Railroad from Mahl north, was killed in a wreck Nov. 18. Mr. Blackwell was in the caboose of the train backing up to Mahl when it struck a cow and was derailed, the train going down an embankment.

—Mr. F. L. Blendinger, who has just resigned as Superintendent of Telegraph of the Erie Railroad, becomes President of the Bailey & Blendinger Manufacturing Company of Woburn, Mass., manufacturers of knives and saws. Mr. Blendinger has been in railroad service in various capacities for 23 years.

—Mr. Bruce W. Duer's promotion to the Superintendency of the Pittsburgh Division of the Baltimore & Ohio, to succeed Mr. S. P. Hutchinson, comes after a continuous service of 14 years with this company. Mr. Duer is 35 years of age and began his railroad service when quite young with the New York, Philadelphia & Norfolk. He later resigned from this company to go with the Baltimore & Ohio as station agent and has passed through various subordinate positions until his new appointment as above.

—Mr. M. K. Barnum, the new Assistant Mechanical Superintendent of the Southern Railway, is a graduate of the Syracuse (N. Y.) University. After taking the degrees of A.B. and A.M. he entered the service of the Erie Railroad as an apprentice and machinist and remained there two years. He then went to Buffalo as Assistant Engineer of Motive Power, and in 1887 he was appointed General Foreman. Mr. Barnum resigned from this company in December, 1888, to go with the Louisville & Nashville as General Foreman, but resigned in 1889 and went with the Atchison, Topeka & Santa Fe as Assistant Master Mechanic. In 1890 he was appointed Superintendent of the Union Pacific, and the following year (1891) was transferred to North Platte, Neb., as District Foreman, and in 1898 he was made Master Mechanic at Omaha, which position he held until Dec. 10, this year, when he resigned to go with the Southern at Washington.

—We printed Nov. 28 a notice of the death (Nov. 24) of Mr. Joseph M. Wilson. Below will be found the resolution passed by the vestry of his church:

At the stated meeting of the vestry, held on Monday, Dec. 1, 1902, the following action was taken on the death of Mr. Joseph M. Wilson, for several years vestryman of St. Stephen's Church, Philadelphia:

Resolved, That in the death of the late Joseph M. Wilson, Esq., this vestry is sensible of a heavy, in some respects an irreparable, loss. Mr. Wilson was a man in whom the power and the beauty of the Christian religion conspicuously manifested themselves. Though averse to confessions on street corners, and though rarely alluding to his Christian belief, Mr. Wilson made this faith the solitary guide of his life. Confronted constantly with difficult problems, he knew no other standard of conduct than the example of Jesus and his own very delicate sense of honor. Just in all his relations, generous to a fault, truthful in word, pure in spirit, a loving husband, father, brother and son—these moral virtues only added luster to the endowment of a naturally powerful mind; nor did his religious beliefs prove inimical to scientific attainments which placed him at the head of an exacting profession. While mourning the loss of a faithful friend and colleague, we, his associates, bear this testimony to our sense of Mr. Wilson's worth, and express our gratitude for the example of an honest man.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—W. H. Hamilton, heretofore Acting Master Mechanic, has been appointed Master Mechanic.

Baltimore & Ohio.—W. C. Loree has been appointed Superintendent of the Chicago Division, with headquarters at Chicago, Ill., succeeding D. D. Carothers, promoted, effective Dec. 18. (See Baltimore & Ohio Southwestern.)

Baltimore & Ohio Southwestern.—D. D. Carothers, heretofore Division Superintendent of the Baltimore & Ohio, has been appointed General Superintendent of the B. & O. S. W., with headquarters at Cincinnati, Ohio.

Chicago & Alton.—G. W. Ball has been appointed Acting Master Mechanic, with headquarters at Slater, Mo., succeeding C. Skinner, resigned.

Chicago & Eastern Illinois.—J. P. Reeves, heretofore Cashier, has been appointed Assistant Treasurer, with headquarters at Chicago.

Cincinnati, Georgetown & Portsmouth.—P. T. Dunn, Superintendent, and W. B. Woodruff, Roadmaster, have resigned.

Cleveland, Cincinnati, Chicago & St. Louis.—A. W. McLaren has been appointed Secretary to the President.

Cumberland Valley.—On Jan. 1, M. C. Kennedy, Vice-President, will also assume the duties of General Superintendent. Geo. W. Martin has been appointed Superintendent, succeeding J. F. Boyd, who becomes Purchasing Agent.

Delaware, Lackawanna & Western.—L. T. Canfield, Master Car Builder, with headquarters at Scranton, Pa., has resigned, effective Dec. 31. It is understood that Mr. Canfield has taken a position with the American Car & Foundry Company.

Des Moines, Iowa Falls & Northern.—The officers of this company are: President, E. S. Ellsworth; Vice-President, Wm. Welden; Secretary, J. H. Funk; Treasurer, W. H. Woods, and Auditor, W. V. Shipley. (See R. R. Construction column.)

Eel River & Eureka.—B. F. Porter has been appointed Superintendent, with headquarters at Eureka, Cal.

Erie & Kalamazoo (Lake Shore & Michigan Southern).—C. E. Warren has been elected Treasurer.

Grand Trunk.—A. B. Atwater has been appointed Assistant to the President of the Grand Trunk Western, with headquarters at Detroit, Mich. His duty will be to represent President Hays in connection with the G. T. W., and the other lines of the Grand Trunk System, west of Detroit and Port Huron. C. O'Dell, Roadmaster, has been transferred from Toronto to the Sarnia tunnel, and C. E. Crowley succeeds Mr. O'Dell. J. Henry, heretofore Roadmaster at Sarnia, succeeds C. Dallas as Roadmaster at Wingham. Mr. Dallas has resigned.

Granger, Georgetown, Austin & San Antonio (Missouri, Kansas & Texas).—At a meeting of the stockholders held recently, A. A. Allen was elected President, and C. M. Jones, Vice-President, Secretary and Treasurer. (See R. R. Construction column.)

Gulf & Interstate of Texas.—J. W. Campbell has been appointed Receiver, succeeding J. P. O'Donnell, resigned.

Illinois Central.—Owing to ill health, C. Dougherty, Division Superintendent at Clinton, Ill., has resigned, and J. J. Gaven, heretofore Trainmaster, has been appointed to succeed Mr. Dougherty.

G. W. Taylor has been appointed General Foreman, with headquarters at Clinton, Ill.

Kansas City, Mexico & Orient.—R. Harding (Third Vice-President and General Manager of the Missouri Pacific) has been elected a Director of the K. C., M. & O.

Kansas City Southern.—E. Holbrook, Chief Engineer, has resigned and that position has been abolished. A. F. Rust, Resident Engineer, will assume the duties discharged by Mr. Holbrook.

Knoxville & Bristol.—B. M. Robinson has been elected President, with headquarters at New York city, succeeding H. J. Braker, resigned.

Lake Erie & Detroit River.—A. Patriarche, heretofore Traffic Manager of the Pere Marquette, has been appointed General Traffic Manager of the L. E. & D. R.

Maricopa & Phoenix.—B. F. Porter, General Superintendent, has resigned. (See Eel River & Eureka.)

Marietta, Columbus & Cleveland.—P. M. Seymour has been appointed General Freight and Passenger Agent.

Mexican Central.—W. A. Frost has been appointed General Auditor, with headquarters at Mexico. E. C. Buchanan has been appointed Auditor of Receipts, and John Ashley, Acting Auditor of Disbursements.

Michigan Central.—R. C. St. John has been appointed Assistant Chief Engineer, with headquarters at Detroit, Mich.

Norfolk & Western.—James S. Pearce has been appointed Master Mechanic of the Scioto and Cincinnati Divisions, with headquarters at Portsmouth, Ohio, and Herbert T. Herr, heretofore Division Master Mechanic of the Atchison, Topeka & Santa Fe, has been appointed Master Mechanic of the Eastern General Division of the N. & W., at Roanoke, Va.

Northern Pacific.—B. E. Palmer, Division Engineer at Spokane, has been transferred to Livingston, Mont. Division Engineer G. A. Kyle, of Tacoma, will have charge of all lines west of Spokane.

Pennsylvania.—According to newspaper accounts the following changes will take place amongst the officers of the Pennsylvania Railroad: W. W. Atterbury, General Superintendent of Motive Power, to become General Manager, succeeding J. B. Hutchinson, who has been appointed Assistant to the Second Vice-President; R. N. Durborow, Superintendent of Motive Power, Pennsylvania Railroad Division, to become General Superintendent of Motive Power; J. R. Wood, General Passenger Agent, to become Passenger Traffic Manager; G. W. Boyd, Assistant General Passenger Agent, to become General Passenger Agent. We are officially informed that none of these appointments have been made.

J. L. Cunningham has been appointed Foreman of Car Shops, with headquarters at Bedford, Pa., succeeding J. R. Bowie.

Pere Marquette.—A. Patriarche, Traffic Manager, has resigned. (See Lake Erie & Detroit River.)

Richmond, Fredericksburg & Potomac.—W. F. Kapp has been appointed Superintendent of Shops and Machinery.

St. Louis, Memphis & Southeastern.—F. E. Dewey has been appointed Superintendent of Construction.

St. Louis Southwestern.—R. E. Kimbell has been appointed Assistant General Auditor, with headquarters at St. Louis, Mo.

San Pedro, Los Angeles & Salt Lake.—E. M. Jessup has been appointed Engineer of Maintenance of Way, with headquarters at Los Angeles, Cal., succeeding R. K. Brown, resigned.

Santa Fe Central.—H. Alexander has been appointed General Manager, with headquarters at Santa Fe, N. Mex. W. C. Hagan has been appointed Secretary and T. L. Clark, Treasurer, both with headquarters at Pittsburgh, Pa.

Southeastern Mississippi Valley Association.—W. R. Ramsey, heretofore Chief Clerk, has been appointed Secretary. Office at Louisville, Ky.

Southern Pacific.—W. C. Farrington has been appointed Manager of the company's Atlantic Coast steamship lines, with headquarters at New Orleans, La., effective Jan. 1.

Union Pacific.—George Thompson has been appointed Master Mechanic of the Nebraska Division, with headquarters at Omaha, Neb., succeeding M. K. Barnum.

United Verde & Pacific.—J. W. Sharp has been appointed Auditor and General Freight and Passenger Agent, with headquarters at Jerome, Ariz., succeeding P. P. Hastings, resigned.

RAILROAD CONSTRUCTION.

ARKANSAS & NORTHERN.—An officer writes that the projected route of this road is through Pocahontas, Black Rock, Newark and Newport, a distance of 75 miles. No contracts have as yet been let. The work will include one steel bridge and two medium sized trestles. J. H. Myers, Black Rock, Ark., is President.

BATH-CENTER VALLEY (PENNSYLVANIA).—It is said that the Bethlehem Construction Co. will build a new trolley line between Bath and Center Valley, Pa., via the slate regions, a distance of 20 miles. This line will connect with the Philadelphia & Lehigh Traction at Center Valley and will shorten the distance between Bath and Philadelphia by 15 miles.

Bering Sea & Council City.—This company was incorporated in New Jersey Dec. 10, by Wm. V. Bloom and Jacob De Hart, of Camden. They propose to build from a point on the Bering Sea, in Alaska, to Council City, a distance of 50 miles.

Bessemer & Lake Erie.—Press reports state that the directors of this road have decided to spend $2,000,000 for the improvement of property. Plans have been approved for building 130 miles of double track, and a new yard will be built at North Bessemer, Pa.

Biloxi, Waynesboro & Cahawba Valley.—This road has been incorporated in Mississippi to build from Biloxi to a point on the Tombigbee River in Alabama.

Bradshaw Mountain (Santa Fe, Prescott & Phoenix).—An officer writes that work is now in progress on a branch road from Turkey Creek, Ariz., to the Ore Cobre mine, a distance of four miles. The contractors are Grant Bros., Los Angeles, Cal.

Brandon & Southwestern.—At the next session of Parliament this road will apply for permission to build an extension from Gladstone to a point near Lake Winnipegosis, and thence in a northerly direction to a point near the River Saskatchewan.

British Columbia Northern & Mackenzie Valley.—Application will be made at the next session of Parliament to incorporate a company to build from the Naas River along the Naas Valley to the northern boundary of the province. C. H. Lugrin, Victoria, B. C., is interested.

British Columbia Roads.—Application will be made at the next session of Parliament for incorporation of a company to build from the coast to the Pine River, and from there to the eastern boundary of the province, with a branch to Burrard Inlet. Robertson & Robertson, Victoria, B. C., are acting for the promoters.

Buckhannon & Northern.—See Railroad News.

California Roads.—An officer writes that five miles of road have been built from last year's terminus of the Eldorado Lumber Company's line towards Placerville, and that the remaining 12 miles from the present terminus to Placerville are under survey.

Canton & East Liverpool.—On Dec. 8 charter was granted this company by the State of Pennsylvania. It is proposed to build a road from a point near Beaver Creek to a point on the Cleveland & Pittsburgh in the town of Smith's Ferry, Pa. Geo. H. Stein, Philadelphia, is President.

Chesapeake & Ohio.—The following miles of road are now under construction: From Whitehouse, Ky., to Elkhorn City, Ky., 76 miles, Langhorn, Johnson & Co., Richmond, Va., contractors; Midkiff to Logan, W. Va., 38 miles, Carpenter, Wright & Co., of Midkiff, W. Va., contractors; Acme to Lawson, W. Va., 17 miles, Carpenter, Frazier & Baxley, of Acme, contractors. (Official.)

Chicago & Eastern Illinois.—The Cleveland, Cincinnati, Chicago & St. Louis will double track their line from Pana to Hillsboro, and will build a cut-off from Hillsboro to Mitchell, about 44 miles long. The Chicago & Eastern Illinois R. R. will have joint use of this track. (Official.)

Chicago, Burlington & Quincy.—Work is reported in progress on 10 miles of double track between St. Joseph and Amazonia, Mo. McArthur Bros., of Chicago, are the contractors.

Columbus & Lake Michigan.—An officer writes that at the present time 60 miles of road between West Unity, Ohio, and Coldwater, Mich., are being built, and 40 miles out of Lima are under survey.

Cripple Creek & Pueblo.—Articles of incorporation were filed on Dec. 9 by this company at Cripple Creek. The proposed route is 33 miles long, extending from Cripple Creek to Pueblo. The road will involve a number of tunnels, and the motive power will probably be electricity. B. Casey, of Boston, is President.

Danville & Western.—An officer writes that no new track has been built on this road during the past year, but that the road from Danville to Martinsville (43 miles) has been made broad gage.

Delaware & Hudson.—An officer writes that the standard gaging of this road from Plattsburg to Saranac Lake, a distance of 73 miles, is now well under way. The relaying of ties, rails and ballast from Saranac Lake to Lake Placid, a distance of nine miles, is also in progress. Sundstrom & Stratton, of New York City, are the contractors.

Des Moines, Iowa Falls & Northern.—According to most recent advices, this line, running from Iowa Falls to Des Moines, Iowa, a distance of 75 miles, will be completed at the end of this month. The grading has reached the outskirts of Des Moines and track has been laid to within a mile of the city. E. S. Ellsworth, Iowa Falls, has been elected President, and Wm. Welden, Vice-President. (Nov. 21, p. 902.)

Detroit Southern.—An officer writes that work is now in progress on the section between Lawrence Furnace and Bloom Switch, Ohio, a distance of 19 miles, and from Bloom Switch to Jackson, Ohio, a distance of 23 miles. Gilman McNeill & Co. are the contractors.

Erie.—Plans have finally been decided upon for building the passenger tracks over Bergen Hill to relieve the traffic through the tunnel at Jersey City, but an officer tells us that there is no prospect of beginning the work soon. This work is part of the Jersey City Terminal improvements described and illustrated in the *Railroad Gazette*, Jan. 29, 1897. The work of elevating the tracks in the city has been completed but the work of providing extra tracks out of Jersey City, in addition to the two tracks now in the tunnel, has been delayed on account of the lack of funds.

Eureka & Klamath River.—An officer writes that work is under way by the company's forces from Little River in a northerly direction for a distance of 10 miles in the State of California.

Federal R. R.—This road will run from Chamberlain, S. Dak., to Rapid City. No track has yet been laid but the contracts will be let the last of January, 1903. The character of the work is mostly light. There will be two steel bridges on the line, but no trestles or tunnels. Wm. T. Coad, Rapid City, S. Dak., is President. Wm. M. Wright is Chief Engineer. (Official.)

Fort Smith & Western.—It is reported that work has been begun on an extension from Fort Smith to Spiro, Ind. T., a distance of 15 miles.

Granger, Georgetown, Austin & San Antonio.—The charter of this road was filed on Dec. 6 at Austin, Texas. It is proposed to build from Granger, Texas, to San Marcos or Lockhart, about 80 miles. A. A. Allen, James Hagerman, G. A. Hickok and others, all of Dallas, Texas, are the incorporators.

Gulf & Ship Island.—An officer writes that no additions have been made during the current year, but surveys are now in progress from Mendenhall to Silver Creek, Miss., a distance of about 32 miles, work on which will begin very shortly.

Illinois, Iowa & Minnesota.—A charter has been granted to this road by the Secretary of State of Illinois, and it is proposed to build from Momence, Ill., through Kankakee, Grundy, Kendal, DeKalb and other counties, to points in Iowa and Minnesota not yet determined. John C. Murphy and Vermont L. Taylor, of Aurora, Ill., are interested.

Interoceanic of Mexico.—An officer writes that a branch is now being built from Cuantla to Chietla, a distance of 9½ miles, and from Virreyes to San Nicolas, a distance of 17½ miles. Hampson & Smith are the contractors.

Iowa & St. Louis.—Press reports state that this line proposes to build from Macon to St. Louis, a distance of 150 miles, and from Centerville, Iowa, to Sioux City, about 200 miles. The line now extends from Macon, Mo., to Centerville, Iowa, a distance of 85 miles. H. F. Reddig is President.

Kootenay Pass & Fort Churchill.—Application will be made at the next session of Parliament for the incorporation of a company to build from Kootenay Pass, on the eastern boundary of British Columbia, to Fort Churchill, on Hudson Bay.

Lake Erie & Detroit River.—Surveys are now being made between St. Thomas, Ont., and Niagara, a distance of 115 miles. Contracts for this work will be let early in the spring. Owen McKay may be addressed at Walkerville, Ont.

Louisville & Nashville.—This road has just completed 30 miles of double track between Shepherdsville and Lebanon Junction, Ky. (Aug. 29, p. 681.)

Manchester, Dorset & Granville.—The contract for the first five miles to Dorset has been awarded to L. C. Farnum, of Boston. O. W. Norcross, of Worcester, Mass., is President, and W. C. Tobin, Treasurer. (Dec. 12, p. 954.)

New Mexico Northern.—This company filed papers of incorporation at Santa Fe on Dec. 2. A road will be built from the mining camp of Bland to a connection with the Atchison, Topeka & Santa Fe near Thornton, N. Mex., a distance of 20 miles. Dr. Patterson, G. L. McKinney and others, of Chicago, are interested.

Northern Pacific.—Surveys are reported completed for a line from Port Angeles to Hoquiam, Wash., a distance of 80 miles. A line is also being surveyed between Gray's Harbor and Willapa Harbor, a distance of 25 miles.

Oregon R. R. & Navigation.—It is reported that the survey on the Echo cut-off from Echo to Coyote, Oregon, 22 miles, is completed, and that grading will begin shortly.

Paragould Southeastern.—It is reported that the extension of this road from Hornersville, Mo., to Blytheville, Ark., 15 miles, will be completed by Jan. 15, 1903. The road now runs from Paragould to Hornersville, a distance of 35 miles.

Pine Bluff & Arkansas River.—This road has issued $25,000 in 5 per cent. bonds to cover the cost of building a five-mile extension from English to Reydel, Ark. The line is now worked from Rob Roy to English, a distance of about 20 miles.

Red Deer Valley.—Application will be made at the next session of Parliament to revive the corporate powers of this company. It is proposed to build from Calgary along the Red Deer River Valley.

St. Louis & San Francisco.—An officer writes that a road is now being built from Madill, Ind. T., to Ardmore, Ind. T., 23 miles, and from Ashdown, Ark., to Hope, Ark., a distance of 33 miles, and from the Choctaw Northern crossing to Vernon, Texas, a distance of 167 miles. Johnston Bros., of St. Elmo, Ill., are contractors. A road from Scullin, Ind. T., to Sulphur, a distance of nine miles, is projected.

St. Louis Valley.—An officer writes that at present 26 miles of new road are being built out of De Soto, Ill. The J. A. Ware Construction Co., of St. Louis, are the contractors.

Santo Domingo Southern.—Charter was granted this company in New Jersey on Dec. 5. It proposes to build from a point in the city of Santo Domingo to the city of San Cristobal, a distance of about 25 miles, and from there to the city of Bani, a distance of about 25 miles, and from there to Puerto de los Calderos. The incorporators are Geo. R. Radford and Henry Adams.

South & Western.—An officer writes that 130 miles of road are now building. Fifty miles between Virginia coal fields in Wise County, Va., and southern connections are under survey.

Southern.—An officer writes that the following lines are now being built: From Searcy, Ala., to Central City, 13½ miles; from Spring Garden, Ala., to the mines of the Alabama & Georgia Iron Co., about 4½ miles. Grading will be completed this month. From Rock Run, Ala., to the mines of the Bass Foundry & Machine Co., about three miles. Grading will be completed this month. From the Roswell branch to Morgan's Falls, about 2½ miles; will be completed about March 1, 1903. The following lines are under survey: Middlesboro to Harlan, Ky., 45 miles; Jellico, Tenn., to Middlesboro, Ky., 10 miles; Harrodsburg to Danville, Ky., nine miles. Grades are being changed and double tracking put in on the Washington Division between Alexandria and Orange, Va., and on the St. Louis Division between East St. Louis and Evansville, Ind.

South Georgia & West Coast.—An officer writes that work is now in progress on a section between Greenville, Fla., and Perry, a distance of 26 miles, and that a survey has also been made from Perry to Deadman's Bay, a distance of 60 miles.

Texas Roads.—It is reported that Carlisle & Co., of Kansas City, have acquired extensive pine timber lands in east Texas and propose to build a railroad through their property. It will run from a point on the Missouri, Kansas & Texas to a connection with the Warren, Corsicana & Pacific, a distance of 40 miles.

Valdez, Copper River & Yukon.—This road has been incorporated at Seattle, Wash., to build from Valdez through the Copper River Valley to Eagle City, Alaska, a distance of about 400 miles.

Wabash.—The contract which was awarded a short time ago to Clement & Co., Philadelphia, for building 71 miles of road through West Virginia from Sandy Bend to Burnsville, was not accepted by the contractors, and has been let to M. McArthur, W. W. Magee and J. R. McArthur, of Chicago.

Weatherford, Mineral Wells & Northwestern (Texas & Pacific).—It is reported that this road which was recently acquired by the Texas & Pacific, will be extended from Mineral Wells, Texas, to Jacksboro and Graham, a distance of 70 miles.

Western Ohio Electric.—See our issue of Dec. 12, page 942.

West Virginia Central & Pittsburgh.—An officer writes that work is now in progress on an extension between Cheat Crossing and Dublin, W. Va., a distance of 25½ miles.

Yankee Hill-Alice (Colo.).—A survey is being made for a narrow gage railroad from Central City through Yankee Hill to Alice. J. Wilson, Des Moines, Iowa, is Chief Engineer. The distance is 15 miles.

Yankton, Norfolk & Southern.—An officer writes that this line is expected to be in operation from Yankton, S. Dak., to Minneapolis, by Jan. 1, 1904. Contracts for the greater part of the distance have been let.

GENERAL RAILROAD NEWS.

New Incorporations, Surveys, Etc.

Annapolis, Washington & Baltimore.—This road has been sold to the Washington, Baltimore & Annapolis Electric. No statement of new plans will be made until March 1, 1903, when the transfer of the property occurs.

Atlantic Coast Line.—Circulars are reported sent to the stockholders of this line, offering subscription rights at $125 a share, to the $15,000,000 of new stock to be issued as part payment for 306,000 shares of Louisville & Nashville. The stockholders may subscribe to the amount of 40 per cent. of their holdings, one-quarter to be paid on Dec. 20, and the remaining three-quarters before Jan. 14.

Baltimore & Ohio.—This company has recently purchased 16 miles of road between Ravenna and Akron Junction from the Lake Shore & Michigan Southern. This was formerly the old Brice Line and its purchase will greatly facilitate the building of the new Baltimore & Ohio line from New Castle Junction to Akron.

Buckhannon & Northern.—The franchises and stock of this company have been transferred to the Blair Syndicate, a part of the Wabash System. A line 72 miles long will be built to connect with the Little Kanawha.

Georgetown & Western.—This road has gone into the hands of a receiver. It was completed in 1901, and extends from Georgetown to Lanes, S. C., a total distance of about 62 miles. Freeman S. Farr has been appointed receiver.

Gulf & Brazos Valley.—An officer writes that the charter of this road has been forfeited and that the rails have been taken up. It was chartered in March, 1898, to build from Eagle Pass, Texas, to Chandler, Okla. T., and Houston, Texas, and had completed 10 miles between Peck City and Mineral Wells, Texas.

Hocking Valley.—On Dec. 4, J. P. Morgan & Co. issued a syndicate agreement which calls for the deposit of the common stock of this company with the syndicate and proposes a retirement of the preferred stock. *The Commercial and Financial Chronicle* says that on Dec. 31 each subscriber who has paid a certain part of the expenses, is entitled to receive back the number of shares he deposited, or a like amount from the proceeds of the sale of this stock. The preferred stock may be called at par at any time by the syndicate. The common stock is to be rated at $97.50 a share (market price on Dec. 4) in case of any sale that may be made. The agreement will not be effective until one-half the outstanding common stock shall have been deposited.

Knoxville & Bristol.—This road was recently sold to a syndicate headed by Bird M. Robinson, President of the Harriman & Northeastern. It was built about 12 years ago and extends from Morristown to Corrytown, Tenn., a distance of 40 miles. No statement with regard to new plans has as yet been made.

Maumee Valley Railway & Light.—Articles of consolidation were recently filed by the Toledo & Maumee Valley, and the Toledo, Waterville & Southern, under the name of the Maumee Valley Railway & Light Co.

Pittsburgh & Lake Erie.—Notices have been sent out by this company that $2,000,000 of the stock that remains in the treasury will be issued to stockholders of record Jan. 31, 1903. This will complete the increase in capital from $4,000,000 to $8,000,000, which was authorized last year. Shareholders only will have the right of subscription to the amount of one-third of their holdings. Press reports state that the proceeds will be used for laying a third track between Pittsburgh and Youngstown, a distance of 68 miles.

St. Louis Terminal.—The stockholders of this road at a recent meeting decided to increase the capital stock and bonded indebtedness from $12,000,000 to $50,000,000. This increase is to pay for recently acquired properties.

Stockton & Beckwith Pass.—Articles of incorporation have been filed in San Francisco for a line from Stockton to Sacramento; to Oroville, through Butte County to the Feather River, along this river to the Delaney Canyon and across the Sierra Valley to Beckwith Pass, a total distance of about 160 miles. The directors are H. L. Fortman, J. Dazell Brown and others, all of San Francisco.

Western Maryland.—The syndicate which is financing this road has called for the payment on Dec. 31 of the last installment of 40 per cent. on the issue of $25,000,000 first mortgage bonds. Out of this bond issue a part will be spent to build the 65-mile link from Cherry Run, W. Va., to Cumberland, Md. The remainder will be used for building the tidewater extension in Baltimore and other terminal improvements.